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Twelve-Inch Swing, Six-Foot Bed Engine Lathe.

This lathe is designed to meet the demand for a heavy and strong lathe of its class.

It has a large forged steel spindle, with a $\frac{3}{8}$ inch hole through its length. The cone pulley is for a 2″ belt. The gears for reversing the feed are forged from steel; they are placed inside the treadstock, and are operated by a lever with a spring-catch, allowing the change to be made with one hand, and without the use of a wrench.

The rest is gibbed on both the front and back sides of the bed, and has a bearing of thirteen inches on the ways. A piece, in diameter equal to the full swing of the lathe, can be faced up without changing the tool.

The lead screw is of steel, eight threads to the inch. It is placed on the front side of bed, and protected from chips by the projection of the bed. Change-gears are furnished for cutting threads up to 32 to the inch. Open and shut-nut is used. This screw is used only for screw-cutting.

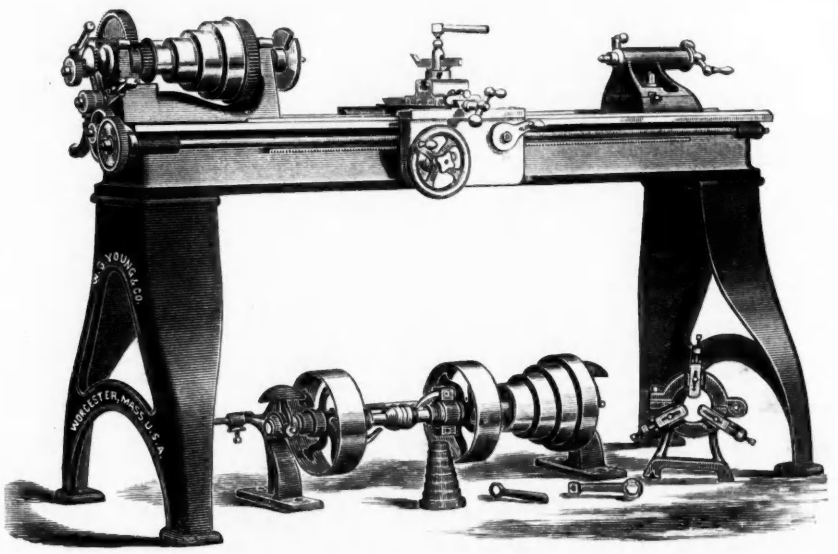
The friction feed is operated by a steel worm working on a splined screw. The rack is cut and fastened to the side of the bed, below the screw, permitting the latter to be placed as close to the underside of the ways as it can be run. In this position it works to the best possible advantage.

The tail-stock has long bearing on the ways, and is clamped by two bolts. Cross-motion for setting center out of line is operated by one screw, giving positive motion in both directions. The tail-spindle is $1\frac{5}{16}$ inch in diameter, and has a motion of 5 inches.

The bed is deep, and has double cross-ties every 12 inches of its length. It rests on legs having a spread of 28 inches on the floor.

Wrenches, center-rest, face-plate centers, etc., are furnished.

W. C. Young & Co., 17 Hermon street, Worcester, Mass., are the manufacturers.



TWELVE-INCH ENGINE LATHE.

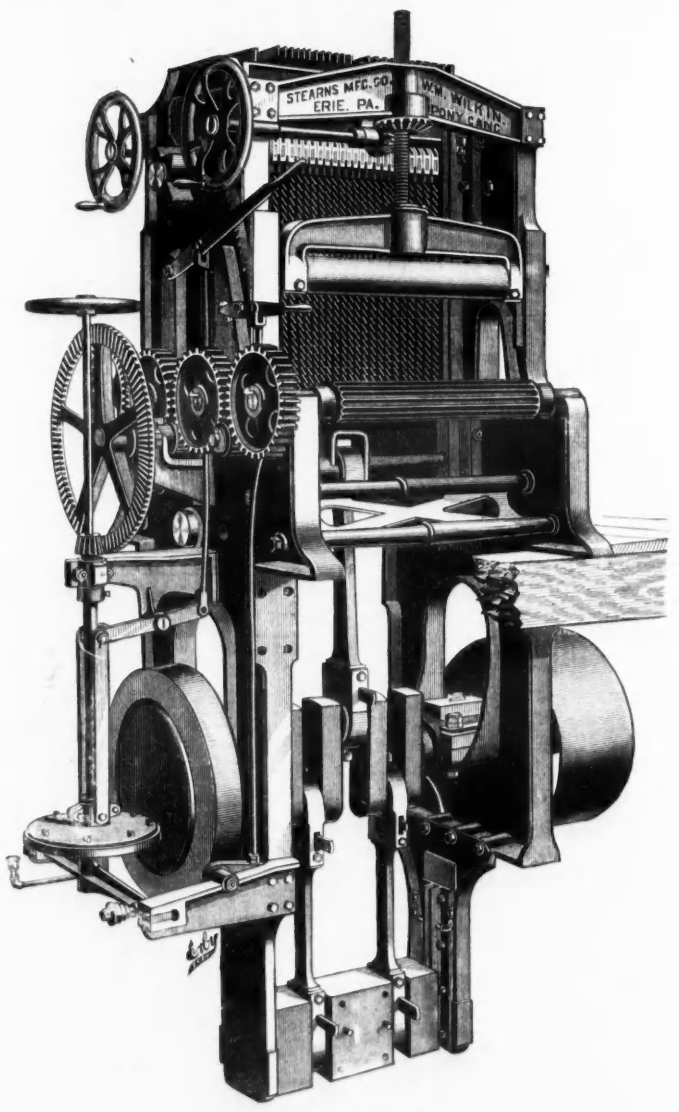
The Wilkin Compensating Gang Saw-Mill.

The cut shows the principles and construction of this machine as built by the Stearns Manufacturing Company, of Erie, Pa. As will be seen by those familiar with the subject, the radical departure in this machine from previous practice consists in the adoption of a device for preventing the excessive vibrations to which the ordinary mill is subject. The immense weight of a heavy sash, full of saws reciprocating at high speed, requires, in the old form of machine, enormous weights in the shaft and crank-pin, and an absolutely stable foundation below the pillow blocks.

The Wilkin compensating gang is provided with three cranks, two of which are opposite the third, which is in the center, operating the pitman and sash. Pitmans inverted attach the outside cranks to a counter-weight below, exactly equal to the weight of the sash and its saws. The two lower rods are of the same weight as the upper one, and all the cranks are of the same throw.

It will be apparent that the motions of the sash, being in exactly opposite directions from the motions of the counter-weight, the opposing shocks and vibrations will neutralize each other; and the machine will run without jar at any speed. The shaft and boxes have but to carry the weight of the sash-rods and counter-weight, and transmit the power necessary to do the work. The "kicks" of the rods, being directly opposite, also neutralize each other. By thus depriving the gang of its power to injure itself or the foundation, high speeds become possible, while the cut per stroke is maintained. In this gang the sash is of one casting of steel. It is oscillated near the top, by means of an eccentric, rod and rock-shaft, so timed in reference to the stroke that the saws enter the cut without shock, leave it when stroke is complete, and rise clear of the log, being thrown again into action near the top of the down stroke. The feed is continuous, and variable at the will of the operator.

In the machine shown, the rolls open high enough to take in a 14″ "cant" (flatted log), 32″ wide, or the rolls may be filled up with several smaller "cants" or "flitches," piled in tiers, so that flooring may be rapidly made.



GANG SAW MILL.

The ordinary feed carried is $\frac{1}{4}$″ per revolution of shaft, and the number of revolutions per minute 300. The saws are held by tabs and buckles, keyed at the top. They may be placed any distance apart, for making lumber of any desired thickness, by the insertion of gauge blocks between the buckles. Aside from the saw filing, this machine requires but one attendant, and its capacity is said to be about 40,000 feet of inch-boards or flooring per day.

A Mountain Railroad.

BY A. E. JOHNSON.

The road to which I refer is called the Austin City Railway, which name is rather misleading, as it was not intended for passenger service, but is merely a short piece of road connecting the Manhattan Mines, at Austin, with the terminus of the Nevada Central Railroad (narrow-gauge).

The length of main track, from end of N. C. R. R. to the mines, is two miles and 3,637 feet; the total height raised in this length of track is 886 feet; the average grade per mile is $329\frac{58}{100}$ feet.

The grade of first mile, which is the steepest part of the road, is 364 feet. The maximum grade is 8 feet per 100. To avoid the expense of heavy cuts and fills the road, to a great extent, follows the natural contour of the mountain. The result is a series of curves, which occur in the following order, commencing at foot of grade: 24°, 40°, 36°, 40°, 38°, 36°, 40°, 36°, 37°, 40°, 40°, 34°, 40°, 30°, 30°, 29°. Several of the strongest curves come on the steepest part of the road, which combines to make quite heavy work for the little locomotive which does the hauling over it.

The motive power is furnished by one Baldwin (3′ gauge) four-wheel connected, tank locomotive, with two-wheeled truck under back end. The principal dimensions are as follows: Diameter of cylinder, 11″.; stroke, 16″; diameter of driving wheels, 33″; wheel base (rigid), 5′; total wheel base, 11′ 7″; weight, 30,000 lbs. This engine proved very satisfactory as to hauling capacity, but a little experience showed that the appliances for controlling the speed while going down the grade would have to be improved. It was found that if the brake should fail to act for a distance of, say, 50 to 100 feet, that a velocity would be acquired that would be almost impossible to control.

Twice during its first season the engine passed beyond the control of the engineer. The first time was through failure of the sand supply on a slippery track; the second time probably from a failure of the brake to operate quickly.

These accidents showed the great importance of having appliances that should give the engineer perfect control of the engine.

With this object in view it was decided first to improve the arrangements for applying sand to the track. To effect this the small sand boxes furnished with the engine were replaced with larger ones, one of which was made in the form of a wide saddle, so as to allow nearly straight discharge pipes.

In addition to these boxes there were placed at the back end of the cab two sand

boxes, connected by flexible pipe to discharge under back truck wheels.

The next consideration was to improve the brake. The engine was originally furnished with a steam brake, operating on a chilled iron disk, secured in halves to the front driving axle. This, when new, was an effective brake, but the disk would wear out of round in a short time, so that when the brake was applied it either locked the wheels instantly, or slowed the engine down with a series of injurious jerks. This brake was also objectionable on account of the heavy strain thrown on the axle and connection.

In addition to this brake there was an auxiliary hand-brake, operating on back drivers. This brake, though a safeguard, was not under the control of the engineer, and did not prove a convenient means of regulating the speed.

To remedy this the disk brake was removed and brake shoes attached by hangers to the frames, so as to bear on the back side of both front and back drivers. These brake shoes were connected by a system of rods and levers, so as to be operated by the old brake cylinder, which was secured horizontally under the boiler. The leverage was then so adjusted that although it would not quite lock the wheels, it would hold the engine on the steepest part of the grade. This system of brakes was also arranged so as to be worked by hand if necessary.

The object of applying the brakes to the back of both sets of drivers was, first, that it was considered that the wear on the driving boxes being all in one direction would have no tendency to throw the engine out of tram; and, secondly, that this arrangement allowed part of the old brake rigging to be used.

With any system of brakes, however, the wear and tendency to heat was considerable, but experiment showed that by attaching a relief-valve to steam-chest, and lowering with the engine reversed, a considerable portion of the work was taken from the brakes.

The relief-valve was made large enough to prevent any dangerous pressure in the steam-chest while lowering at any ordinary speed; when it is necessary to use steam the relief is closed.

Since making these changes the engine has been in nearly continuous service for about four years, and, though requiring careful attention from the engineer, has shown no disposition to escape from his control.

During this time the brake has not been expensive to maintain, and the engine shows no bad effects from running with lever reversed.

Tin ore to the amount of 35,000 lbs. has arrived in New York from the new mines at Harney's Peak in the Black Hills. The output of this mine is likely to exercise an important effect upon the tin-using industries of this country. Hitherto almost all has been imported.

A New Engine.

The Chicago *Journal of Commerce*, in describing a new engine said to have been invented and perfected in Detroit, Mich., by Theodore Bura, says:

As the device is a decided novelty in the science of engine-building, a description will not be out of place. Technically speaking, it is a double compound steam engine of eight horse-power, having neither steam chest, valves, nor eccentrics. It occupies a space about 14 inches square, and is, perhaps, 30 inches high. It consists of three cylinders, side by side, the center one being solid, pistons operating in the other cylinders. The center cylinder is provided with a series of inverted cups, most minutely and accurately adjusted to ports on either side leading to the interiors of the other cylinders. By means of these inverted cups and companion ports, the live steam is distributed, and the expansive force is transferred from one end to the other of the side, three times the power is obtained in the cylinders that is called for on the boiler indicator. The inventor claims that there is a saving of over 50 per cent. in the first cost of manufacturing the engine, and that the same horse-power is obtained with a saving of three-quarters of the fuel now demanded.

It is evident that, even if the device possesses no valve gear, there is an abundance of *crank* concerned in its economy.

Speed of a Newspaper Train.

The Sunday newspaper special train No. 11, August 8th, 1886, on the New York Central and Hudson River Railroad, made the distance from Syracuse to Buffalo in two hours and twenty-four minutes, a distance of 148 miles, at an average speed of 65.6 miles per hour, including a stop for water at Rochester and once slowing up at Batavia. The train was drawn by Engine 541, John W. Cool, engineer. The speed per hour from Syracuse to Rochester averaged 67.27 miles, and from Rochester to Buffalo, 63.72 miles.

As may be seen from the annexed table, the speed in several places exceeded 70 miles an hour; and once, during a 128 mile run from Palmyra to Fairport, a speed of 74.93 miles per hour was maintained for 10 min. 25 sec.:

STATIONS.	DEPARTURE.	DISTANCE.		TIME	RATE
		Total.	Intermediate.	Between Stations.	of Speed per Hour.
	Hrs., Min., Sec.	Miles and Hundredths.	Miles and Hundredths.	Minutes and Sec.	Miles and Hundredths.
Syracuse	10 A. M.	.....	.....	.....	.....
Oswego Junction	10.03 30	3	3	3 30	54 54
Warners	10.09 30	9 34	6 34	6	63 40
Jordan	10.16 30	17 05	7 71	7	66 08
Weedsport	10.20 20	21 39	4 34	3 50	74 40
Port Byron	10.23 20	24 76	3 37	3	67 40
Savannah	10.29 35	31 76	7	6 15	68 29
Clyde	10.35	37 96	6 20	5 25	70 85
Lyons	10.41 50	45 33	7 37	6 50	68 03
Palmyra	10.52 35	57 84	12 51	10 45	71 82
Fairport	11.03	70 64	12 80	10 25	74 93
Rochester	11.12	80 73	10 09	9	67 27
Rochester	11.20	.....	.....	.....	.....
Coldwater	11.25 35	86 89	6 16	5 35	69 08
Bergen	11.35 15	98 44	11 55	9 40	73 72
Byron	11.42 10	106 16	7 72	6 55	70 72
Batavia	11.50	11 75	6 59	7 50	52 72
Crittenden	12.03 30	128 52	15 77	13 30	71 14
Grimesville	12.12	138 11	9 59	8 30	69 33
Buffalo E. St	12.24	148 70	10 59	12	52 95

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

TWENTY-FIFTH PAPER.

As near as I can recollect, it was about the year 1820 or 1821, that my grandfather and father jointly invented and constructed with their own hands a most important labor-saving machine, for laying or weaving the faces for laid paper moulds. Previous to that time it had been done entirely by hand, each wire being laid separately as it was to remain, forming the outer face of the mould; the fastenings or twists of each seam were made by hand one after the other. Hence as a labor-saving machine, twisting all the seams at the same time, it was as one to the number of seams in a face. For instance, a mould for making commercial post paper, has about 22 seams, each bar of the mould frame representing a seam. Double cap moulds have from 28 to 30 bars; besides this saving, a uniformity never before approached, was obtained. The faces, being formed or woven independent of the mould frames, were laid on and secured to the under face or foundation by sewing with wire. This, about the year 1824, was the earliest work of the kind I turned my hand to. My elder brother Charles had, about two years previous to this, partially relieved our grandfather from forming the devices for water marks, and sewing them on the moulds, which up to that time, embracing a period of at least 55 years, had been exclusively his work. The manner letters or other devices for water marks were formed of plated copper wire was on blocks of hard wood, faced on the end of the grain, similar to the blocks used for wood engravings. On these were drawn the letters or other devices. Needle points were driven into the block and left projecting slightly above its face at every point where the water mark wire was to be bent. When the blocks were thus prepared the silver-plated wire was held in close contact with them, and wound or bent around these points until the device was formed. It was then carefully raised from the block, laid on the brass plate, the bends adjusted or squared with small hand pliers, previous to sewing on the mould face. This after adjustment was necessary, as no acute angle or square turn could be made around the steel pins. It was not long before my brother improved on this method of forming the devices. He made his designs on metal plates, and used a tool like the watchmaker's small round handled screw driver, notched on its end to straddle the wire to be bent, holding the handle between thumb and fore finger, the wire on the metal plate, by a simple rolling motion of the tool, he could turn a perfectly square turn, follow the device with all the accuracy of the old method, without requiring any after adjustment. At that time all the makers of fine writing papers were very critical as to the uniformity and accuracy of their water marks, such as arrows, dove and olive branch, Robinson's lamb, Kelter's carrier pigeon, and others more elaborate.

Nicholas Biddle, then president of the U. S. Bank, had more faith in security against counterfeiting in the quality of the paper and its water marks, than he had in the most complicated and elaborate engraving. I have frequently heard him argue that engraving, no matter of what quality, could be secretly imitated with but little chance of discovering the operator, but that a paper that could only be produced by machinery of magnitude and of great cost, beyond the reach of the counterfeiter could not be hid away. Many curious devices in water marking were tried at his suggestion. At one time he brought us a specimen of French paper with a shaded water mark. It had evidently been made on a vellum-faced mould, most probably of soft copper wire in which undulations were formed by dies analogous to those used in embossing paper cards. The pulp deposited in the depressions made a slight difference in the thickness of the paper, which being reduced to the uniformity requisite to take a fair impression from the engraved plate, by compression in finishing caused the dark shade around the wire water mark sewed in the bottom of the depressions. These were very difficult moulds to make. The under facing or foundation wires that are about $\frac{3}{16}$" apart on the wooden bars of the mould had to be bent by hand to suit the depressed portions of the wire face. When these paper moulds were completed Mr. Biddle remarked that he now felt safe against the counterfeiters, for they must first obtain moulds and then some mill to make the paper, and he did not believe the owner of any mill in the country could be found so unprincipled as to join them.

How little he dreamed of what Yankee ingenuity could accomplish. Not long after the issue of notes printed on this security paper, the most perfect counterfeits the bank ever had to contend with were put in circulation.

It was several years before it was learned how the counterfeiters had obtained the peculiar water marked paper, in fact not until the old United States Bank had become a Pennsylvania State Institution, and when the facts were learned it was in so singular a way savoring more of romance than reality that I must be excused for what may run into a long digression in relating them. During the frequent conferences with Mr. Nicholas Biddle, in hope of reaching some mode of preventing counterfeiting bank notes, I learned in confidence much of what had been done in the detective line and its results by an unsuspected officer of the bank whose position was high, and who had become so much interested in the pursuit that in disguise he affiliated with some of the most desperate counterfeiters of the period; although both he and Mr. Biddle have passed away, reasons still exist why he must remain nameless. It was through his machinations that the most expert engraver and counterfeiter this country had ever produced was arrested with all his tools and machinery, including a simple and most ingenious eccentric lathe with which he reproduced the work of Spencer's mole lathe, that had never before been done by counterfeiters. The man was convicted and sentenced to the Eastern Pennsylvania penitentiary for a term that, at his age, amounted to a life sentence. The judge in passing sentence, in my judgment, committed a most unpardonable vandalism in ordering the destruction of the unique eccentric lathe and other ingenious appliances, and in seeing the order carried out, with the exception of a few burins and other small tools, which Samuel R. Wood, the then Warden of the Eastern Penitentiary preserved. Mr. Wood was a Quaker, and a most kindly disposed man; he became interested in his prisoner and had wormed out something of the early history of this ingenious mechanic who had gone astray—"through force of circumstances that should be taken into consideration when judging the man." These were Mr. Wood's own words when expressing to Mr. Biddle his belief that if by promises of shortening his term by procuring a pardon, his confidence could be gained, much valuable information tending towards the suppression of counterfeiting would result from it, but without some such course he was satisfied the imprisonment would be of short duration; for labor the man was listlessly picking oakum, and physically rapidly sinking. Mr. Biddle thought the experiment worth a trial. Soon after Mr. Wood reported that he had made no progress; he had tried kindness, but the man had become more reticent; to all his advances he only received muttered monosyllabic replies. I suggested that he might probably be reached by giving him more congenial employment than oakum picking, and proposed substituting die sinking such as was then coming into use for stamping the corner of note and letter papers. Provided with samples and such tools of his as Mr. Wood had preserved, with him I had my first interview with the man in his solitary cell; he was sitting on the side of his cot, his fingers locked together clasping his knees, a bundle of partly picked oakum lay by him; as we entered the cell he glared at us, his high narrow receding forehead, aquiline nose, thin tightly-compressed lips, deep set piercing eyes gave him more the appearance of a caged eagle than a human being. Mr. Wood explained that I had proposed work that he might find relief from oakum picking. He wanted none of it, nothing could kill time; at first he refused to listen to me; when he saw the kind of work he denied having the ability to do it; he had never done it or seen it done. Then looking at me he burst forth in a perfect torrent. "Can you tell me what became of that red-haired fellow who was taken with me; he fought the officers like a very devil, and yet, though I know he was secured and ironed, he was not brought to trial with me; I see it all now, he was a fraud, it was a trick to trap me; if I was only free for a day, and could get my hands on him, his life should pay for it, and I would die contented." Mr. Wood, to quiet him, said the man had a separate trial, and had been sentenced to a long term. His reply was: "I don't believe a word of it, he was too smart for that; he was a splendid fellow with his pen; he never had his equal and never will again; he could raise a note that would defy detection." I took from my pocket and held towards him his old burins and other small tools; he seized them with trembling hands, he fondled them as if they were living; their touch seemed to have totally changed the man—for when Mr. Wood took them from him, explaining that they could not be left with him, he at once agreed to try his hand at the work I proposed.

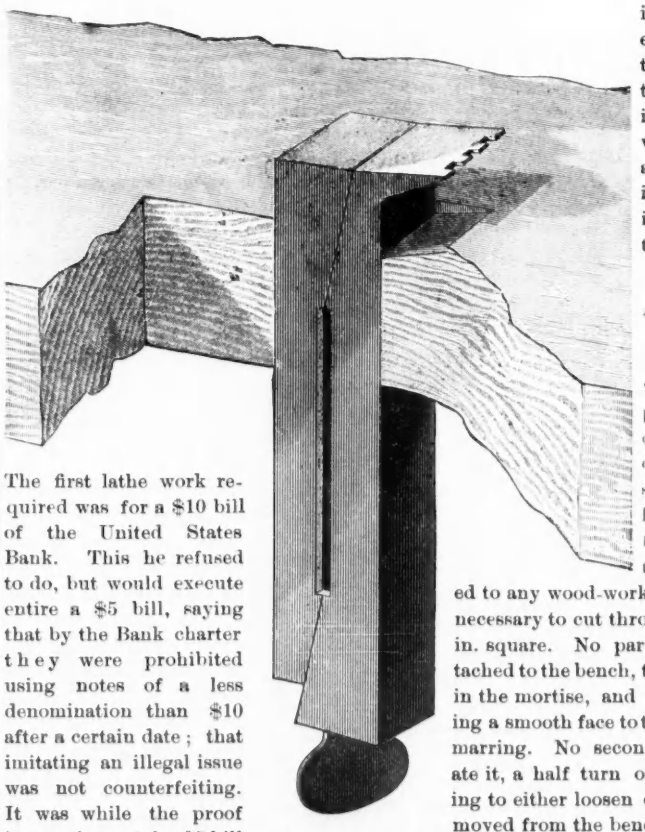
In addition to his little tools he would require a light hammer, a small oil stone, a bench or stool with clamp or vise to work on. It was arranged that the dies and designs should be prepared.

His sentence, in accordance with the Pennsylvania system, was solitary confinement with labor. Hours for this new work were arranged, during which a guard was to be with him, who was to deliver to him the tools and work, taking them away at the expiration of the time. After leaving the cell, Mr. Wood said it was necessary for him to have the consent of the prison inspectors for this change of labor; as to that, he had no doubt they would meet the evening before the time fixed on to initiate the man at his new work.

When I went to the penitentiary with the dies and designs, Mr. Wood informed me that he had been unsuccessful in obtaining the concurrence of the inspectors, who believed the kind of work would keep the man in practice, and that on the expiration of his sentence he would resume his old business. Mr. Wood considered this absurd; for, said he, if the man lives and serves out his term, he will be considerably over eighty years of age.

The inspectors would not give way. Mr. Wood had not told the man of this decision, and preferred that I should do so, in hopes that by showing him the dies, and the preparations that had been made, he might be induced to talk more freely than he had done. As this was the last interview I had with him, and what was learned and resulted from it so far exceeded our expectations, that to be understood it seems necessary to state some things that had been learned in regard to the man and his work, through Mr. Biddle's amateur detective, and one of the hair-breadth escapes he made when in this pursuit, and the mode by which the man was finally secured.

Reliable facts learned were that, although the man was living among counterfeiters, and with them frequently shifting from place to place, he confined himself to certain portions of the work on the spurious plates, for fixed considerations, always exacting his pay in genuine money; that, when flush, he would ometimes go on protracted sprees until his money was exhausted, when he would return to his work; that, when on these spells of reckless dissipation, the counterfeiters kept a strict surveillance over him, fearing that in his drunken orgies he might divulge important secrets; that at that time he was with part of the gang working in a shanty on an island on the St. Lawrence River; there the bank officer went, accompanied by a member of the band, and armed with a forged letter of introduction, purporting to have been written by the master spirit of the gang as he was leaving the country for an absence of some weeks, representing him to be an expert penman, who would prove to be a valuable auxiliary. After a few exhibitions of his ability, he was heartily received among them, and for some days worked alongside of the man he had ventured so much to secure. He soon made himself familiar with all their appliances, and learned many important secrets; but he failed to find any way of convicting without his own testimony, and to give that, divulging his identity as a bank officer, would simply be signing his own death warrant; for such was the d sperate character of the gang. Feeling greatly discouraged, not knowing which way to turn, early one evening he threw himself into his bunk, in the working room, only separated from the living room by a thin board partition. He fell into a troubled sleep, from which he was awakened by unusual sounds from the adjoining room. He was soon aware that there was an unexpected arrival; he distinctly heard an unfamiliar voice say: "This letter is a forgery; I gave no one an introduction; the man is a fraud or a detective, and we must run no risks; we must 'fix' him at once, so he can tell no tales." This was hint enough; and he was not slow to act on it. He slipped out of a window, and although the river was running full of cakes of floating ice, he threw his boots and hat on the bank and took to the water. It was a desperate swim. But fortune favored him; for after over an hour battling with the cakes of ice, he landed on the Canadian shore, fully two miles below, nearly frozen to death, but, fortunately, near a cabin, to which he dragged himself, and found shelter for the night. A spurious story of wreck of boat and loss of companion satisfied the simple people, who gave him a bed, and while he slept dried his clothes. In the early morning, a store at a near railroad station furnished boots, hat and a rough overcoat—a little money paid for services rendered him, and before night he was comfortable in the St. Lawrence Hotel at Montreal, where he had left his baggage, when he started on this desperate island adventure. For safety it was necessary that the counterfeiters should have evidence of his having been drowned. Keeping his room for a few days, consulting with the head of the police and a prominent member of the medical faculty, a corpse was procured, dressed in the clothes he wore on his escape from the island. In the pockets were put such small tools as would identify the body, which was represented as having been taken from the ice in the river. The knowledge obtained on the island enabled the police to make a certainty of having some of the gang view it, as well as the clothes and pocket findings. This being done, the bank officer was safe, as the sequel proved; for, within a year, in the guise of a manufacturer of spurious money, and an expert in raising notes to a higher denomination, he was again in contact with the man—this time at Charleston, S. C. He then, by a liberal advance of money and promises of high price for work, induced the man to come to Philadelphia, where he represented that he had rooms in which the work could be done, so arranged as to defy detection.



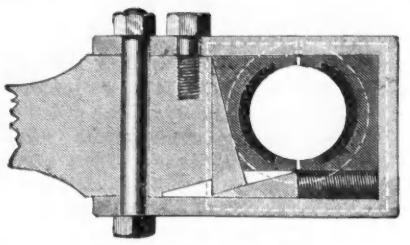
The first lathe work required was for a $10 bill of the United States Bank. This he refused to do, but would execute entire a $5 bill, saying that by the Bank charter they were prohibited using notes of a less denomination than $10 after a certain date; that imitating an illegal issue was not counterfeiting. It was while the proof impressions of the $5 bill were being taken that the police broke in, securing both employer and workmen, with all the machinery and tools, and a partly-finished plate of $10 denomination, found on the work-bench.

I have seen the room where the work was done, and the arrest made, and all the ingenious devices for concealing work, machinery and tools, and the arrangement for escape of operators, apparently perfect, but which proved as perfect a trap as could be devised. When the man sprang for what he believed a certain way to escape, and was met by revolvers in the hands of resolute men, it was natural that his suspicion of treachery should center on his red-haired employer and fellow workman, who he saw so desperately struggling with his captors.

This paper has run to such a length that the final interview, and the results from it must be the subject of my next.

Automatic Take-up for Connecting Rod Boxes.

This is a device which, when applied to a connecting rod, automatically compensates for wear of brasses, holding them at all times to a close fit on the pins. The cut shows it as applied by the inventor to a small engine —6″x6″—upon which it has been running for



some months. It is applicable to all rods, the spring very generally coming in the stub end, instead of as shown here.

As will be seen, the usual broad wedge is used; but instead of the adjusting bolt it is held in place by a supplementary wedge. This supplementary wedge is held in place, and forced under the principal wedge by a spiral steel spring, tempered, and compressed in a drilled hole in the side of one-half of the box. As wear takes place, the supplementary wedge moves forward, forcing the principal wedge to fill the space caused by the wear; and being once moved, it cannot retreat, so long as the spring retains its elasticity. This spring is of sufficient strength to prevent its vibrating by the motion of the crank, and also to overcome the friction of the wedges, and hold them firmly in place, all tendency for crowding on the crank-pin being overcome by the angle of the face of the box resting on the wedge.

It is claimed by the inventor, T. W. Broomell, Christiana, Pa., that this device not only saves the annoyance of pounding, but that the boxes will last fully three times as long. So sure is he of its good qualities that he is willing to put it on trial, subject to approval.

Adjustable Bench Hook

This device is the invention of J. B. Boyce, a practical pattern-maker, of Lockport, N. Y. It is of cheap construction, strong and durable, and has the appearance of being a very convenient tool. It is easily attached to any wood-worker's bench, it being only necessary to cut through the top a mortise, 1½ in. square. No part being permanently attached to the bench, the tool is interchangeable in the mortise, and can be reversed, presenting a smooth face to the work, thus preventing marring. No second tool is needed to operate it, a half turn of the thumb-screw serving to either loosen or fasten. It may be removed from the bench and placed with other tools, securing the owner from loss by theft, as is the liability with tools for this purpose, when screwed to the bench.

BENCH HOOK.

This is the season of the year when the presence of the sea-serpent plays an important part in popular watering-place enterprise. A wonderful amount of imaginative fertility goes to waste, so to speak, every year in conjuring up the form which this monster of the mind ought to take on. Why not stop this waste of mind by making a mechanical sea serpent that could be put through its paces by steam for the satisfaction of those who have a morbid curiosity in that direction? We venture to say that a good mechanician could contrive one that would put in an appearance on time, and be generally more useful in drawing custom and gratifying the curious than the natural monstrosity which never appears except to the "ancient mariner." We offer the sugestion as one that may be made to pay.

Incomplete and Imperfect Combustion.

A correspondent calls our attention to the fact that all writers do not confound incomplete with imperfect combustion, and cites us to a work entitled "The Steam Engine," by H. Northcott. The author of this work is a remarkably clear writer, and his remarks on this subject are worth quoting. He says under Imperfect Combustion: "Although it is usual to speak of imperfect combustion, it should be borne in mind that combustion is never really imperfect. The combustion of any mixture may be partial, so far as the mixture itself is concerned, either from the excess of one of the ingredients, or from the absence of temperature, but the combustion of such portion as does actually combine is always perfect."

The above shows very clearly that the terms "incomplete" and "imperfect" are frequently confused.

James M. Swank, General Manager of the American Iron and Steel Association, contributes a valuable paper to the special report on the mineral resources of the United States. Beginning with 1865, he shows that the increase in the production of pig iron in the United States had increased from 931,582 tons in that year to 4,589,613 tons in 1884. In steel rails the product had increased from 2,550 tons in 1867 to 1,119,291 tons in 1884. Only thirteen States and one Territory made rails in 1885, while nineteen States and one Territory made rails in 1880. This is due principally to the substitution of steel for iron rails. As might be expected, Pennsylvania leads in nearly all iron and steel industries. The following table of the world's production of pig iron will be found interesting:

Years.	Gross Tons.	Years.	Gross Tons.	Years.	Gross Tons.
1800..	825,000	1870..	11,9?0,000	1879..	13,950,000
1830..	1,825,000	1871..	12,500,000	1880..	17,950,000
1850..	4,750,000	1872..	13,925,000	1881..	19,400,000
1856..	7,000,000	1873..	14,675,000	1882..	20,750,000
1865..	9,250,000	1874..	13,500,000	1883..	21,000,000
1866..	9,300,000	1875..	13,675,000	1884..	19,475,000
1867..	9,850,000	1876..	13,475,000	1885..	19,100,000
1868..	10,400,000	1877..	13,675,000		
1869..	11,575,000	1878..	13,925,000		

A Fast Shave.

The *Chicago Herald* tells of a Pullman car conductor who shaves himself when moving fifty miles per hour in his car.

The *Herald* also says: "I know an engineer who regularly shaves himself on his engine. He is a young and handsome fellow—one who likes to look nice all the while—and when he gets out in the country where there is a clear track he lets go the throttle and takes up his razor."

A shave on the lightning express is doubtless a "fast shave," and should an accident occur during tonsorial operations, it would doubtless prove a "close shave" also.

According to Rankine, a cubic foot of steam of atmospheric pressure (14.7 lb.) weighs .03797 lbs. By the same authority, a cubic foot of water at its greatest density weighs 62.425 lb., hence a cubic inch of water evaporated into steam at a pressure of one atmosphere, would occupy a space of 1644 cubic inches.

Mr. J. H. Bartlett, of Montreal, in a pamphlet on the subject shows that while fifty years ago the iron interest was the most important manufacture in Canada, it is now in a deplorable condition, notwithstanding natural advantages second to no other country. This he lays to the non-protective character of their tariff. They cannot purchase their iron, for less, he says, "than it costs in the United States, where the policy opposite to our own, and surely the more enlightened one, prevails." We commend Mr. Bartlett's views to those in this country who undertake to prove that free trade ought to prevail. Let them imagine the condition of manufactures in this country with that of iron left out.

Modern Locomotive Construction.

BY J. G. A. MEYER.

TWENTY-SIXTH PAPER.

In the Twelfth Paper it was explained how to find the position of an eccentric, and how to set the same when no rocker is employed. The subject of setting the eccentrics will now be resumed in the following order:

1st. To find the position of each eccentric, when two are used, so that the motion of the engine can be reversed. No rocker to be employed in this case.

2d. To what extent the position of an eccentric will be affected when a rocker is used,

3d. Effect on the positions of the eccentrics in a locomotive by the use of a rocker.

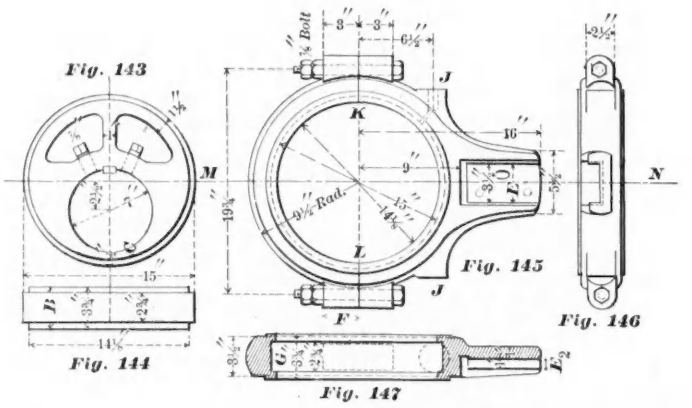
4th. Setting the eccentrics and valve gear of a locomotive in the erecting shop.

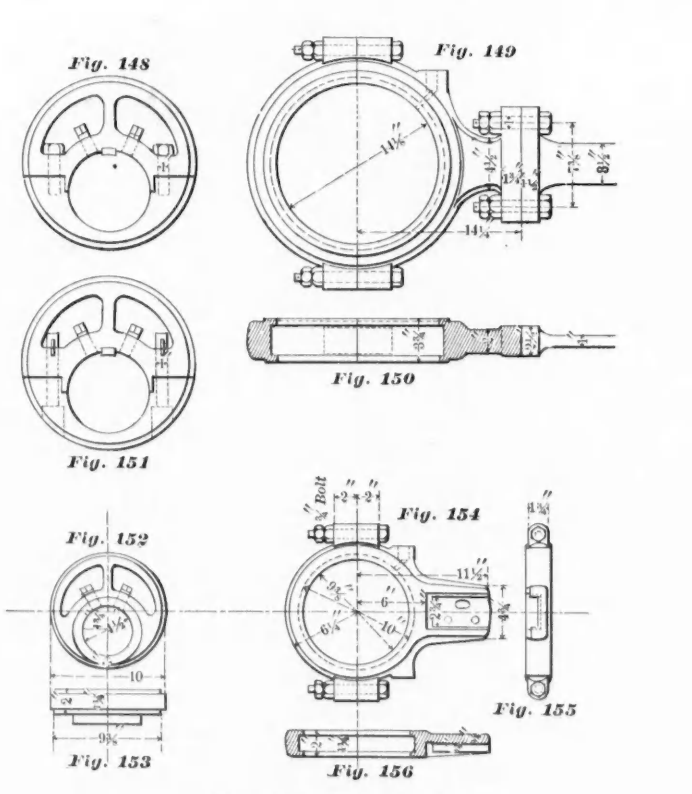
In order to gain a clear conception of this subject, it is advisable to study separately each piece of mechanism that enters in the valve gear of a locomotive, and establish rules that will guide us in the construction of the same. The rocker and its construction have already been explained in the Eighteenth Paper. We will now take up the eccentric and its strap.

In the illustration we have represented various eccentrics and their straps, with all the important dimensions marked upon them. These have been selected from a number of designs of eccentrics made by some of our best locomotive builders. Figs. 143 and 144 represent two views of an eccentric; Figs. 145 and 146 represent two views of its strap, and Fig. 147 a section of the same. Such eccentrics and straps are used on some of our largest locomotives, that is, consolidation engines having cylinders 20″ in diameter and 24″ stroke. Figs. 152 and 153 represent an eccentric, and Figs. 154, 155, 156 represent the strap for the same. Eccentrics and straps of this size are used on our smallest locomotives, namely, eight-wheeled passenger engines with cylinders 10″ in diameter and 18″ stroke. When we say "smallest locomotives" we do not include locomotives for mining purposes, or very light narrow-gauge locomotives. The duty of an eccentric and its strap is to move the slide valve forward and backward, and when, a few years ago, pumps were used in locomotive engines, then occasionally the eccentric was employed to work the pump. The action of an eccentric, as we have stated before, is precisely the same as that of a crank. No peculiar movement must be expected by the use of an eccentric; the slide valve will perform its functions as correctly when it receives its movement from a crank as when it receives its movement from an eccentric; the only reason why an eccentric is adopted is, that the use of the crank is impracticable. In American locomotives the eccentrics and straps are generally made of cast iron; indeed, we may say, they are always made of cast iron, since we seldom find a locomotive whose eccentrics and straps are made of brass or wrought iron. To prevent the strap from slipping sideways off the eccentric a recess marked *G*, Fig. 147, is turned in the strap, which fits a corresponding projection turned on the eccentric. Some builders make the joint *K L*, Fig. 145, perpendicular to the center line *M N* of the eccentric rod; others make this joint not at right angles to the center line *M N*, as shown in Fig. 157. The advantage claimed for the latter is that the stress will be less on the nuts of the bolts which hold the two parts of the strap together. The advantage claimed for the former design is that no right and left-hand pattern for the strap will be required. The oil cup is screwed in one of the hubs *J*; the reason why two hubs are cast on the strap is, as before, to avoid a right and left-hand pattern. The eccentric rod fits into the recess marked $E E_2$, Figs. 145 and 147, and is secured to the strap by three bolts. It will be noticed in Fig. 145 that the hole for one bolt is oblong; this will allow the rod to be moved out or into the recess, as may be required, and then fastened. After the correct position of the rod in the recess has been found, then the other two holes are drilled, reamed, and the bolts driven in tight, so that the distance from the center of the strap to the extreme end of the rod cannot be changed. Some master mechanics object to this arrangement, and prefer to let the eccentric rod butt against the eccentric strap, as shown in Fig. 149. In this case, the distance between the center of the strap and the extreme end of the rod can be changed by placing some thin copper strips between the strap and the rod. The eccentric is generally cast in one piece, but sometimes, for the sake of convenience in repairing, it is made in two parts, as shown in Figs. 148 and 151. For holding the two parts of the eccentric firmly together, some master mechanics use studs and nuts, as shown in Fig. 148; others use bolts with split keys or cutters, as shown in Fig. 151. The writer believes that the latter method is the best, since for the want of room in the design shown in Fig. 148, it is often extremely difficult to gain access to the nuts with a wrench.

During the time of setting the valve gear the eccentrics are held in position by the set screws, but afterwards, in the majority of locomotives, they are keyed to the axle. Of course, in a small number of locomotives, as may be inferred from the foregoing remark, the eccentrics are not keyed to the axle, and are held in position by the set screws only. The set screws are made of steel, cupped as shown in Fig. 159, and then hardened. The key-way in the eccentric is cut before the latter is placed on the axle, but the key-way in the axle is cut after the correct position of the eccentric has been found. To cut this key-way—which must be done by hand—is very troublesome; hence some master mechanics cut no key-ways in the axle, but use two keys, as shown in Fig. 160. In this case each key has on one of its sides teeth cut lengthways, as shown, so that when the keys are driven home the teeth will grip the axle.

The set screws in this case are used as an extra security against the slipping of the keys out of position.





LOCOMOTIVE CONSTRUCTION.

The form of the section of the strap can be made as shown in Figs. 150 and 156, or as represented in Fig. 158. By adopting the form shown in the latter figure, the strap can be made lighter, and still have the same strength as that shown in Fig. 156, but the outside diameter of the strap in Fig. 158 will necessarily be somewhat larger than that in Fig. 156.

The diameter of the eccentric, and also that of the strap, should be made as small as possible, since by so doing not only material will be saved, but also the work expended in friction will be reduced; and lastly, less space will be required for the eccentric to work in. This last fact is of great importance, because in a great number of locomotives the space required for the revolving of the eccentrics limits the length of the fire-box; and, since the available space for the fire-box is often barely sufficient, it follows that space should not be wasted by making the eccentrics larger than necessary. Thus, for instance, in eight-wheeled passenger engines the main driving axle on which the eccentrics are fastened is placed comparatively close to the front end of the fire-box, as shown in Fig. 142, and this distance between the main axle and the fire-box is determined by the space required for the working of the eccentrics. Now, whatever amount the radius of the eccentric is made too large, that same amount must be taken from the length of the fire-box, and thus, to some extent, reduce the steaming capacity of the engine.

Here, then, we see the necessity of making the diameter of the eccentric and that of its strap as small as possible. The distance between the center of the main axle and that of the fire-box is generally 14 to 14½ inches in large locomotives, and from 10 to 10½ inches in the smaller locomotives. But here, then, the question arises, How can the correct diameter of the eccentric be determined? In order to find the diameter of an eccentric, we must know its eccentricity; that is, the distance between the center *y* of the axle and the center *x* of the eccentric, Fig. 142. We must also know the diameter of the axle on which the eccentric is fastened, and the thickness of the metal at *C*. When these items are known, we add together the distance between the centers *x* and *y*, half the diameter of the axle, and the thickness of the metal at *C*, and multiply this sum by 2. Thus, for instance, in Fig. 143, we see that the distance between the center of axle and the center of eccentric—that is, the eccentricity—is 2½ inches, half the diameter of the axle is 3½ inches, and the thickness of metal at *C* is 1½ inch. Adding these dimensions together, we have $2\frac{1}{2}+3\frac{1}{2}+1\frac{1}{2}=7\frac{1}{2}$, and $7\frac{1}{2}\times 2=15$ inches, which is the diameter of the eccentric. From this we see that there are three items whose dimensions determine the diameter of the eccentric, namely, its eccentricity, the thickness of metal at *C* and the diameter of the axle. Here, then, another question arises, How can we find the dimensions of these three items? The diameter of the axle is determined by rules to be explained hereafter; hence there remain only the two former items, whose dimensions will claim our consideration in this paper. In the eleventh paper we have stated that the throw of an eccentric is equal to twice its eccentricity, hence, the throw of the eccentric, shown in Fig. 143, will be 5 inches, because its eccentricity is 2½; we have also stated that the throw is equal to the travel of the valve for engines in which no rocker is interposed. We will now add to this statement, that when a rocker is used, whose arms are of equal lengths, then the throw of an eccentric will still be equal to the travel of the valve; on the other hand if a rocker is used whose arms are not of equal lengths, then the throw will not be equal to the travel of the valve. Consequently, when the travel of the valve is given for an engine that has no rocker, or when the travel of a valve is given for an engine in which a rocker is employed whose arms are of equal length, in either case we must make the eccentricity of the eccentric equal to one-half of the travel of the valve; we cannot make it less or more; hence, in these two cases the shortest distance between the centers *x* and *y*, Fig. 142, will be equal to half the travel of the valve. But when a rocker is used, whose arms are not of equal lengths, then the eccentricity of the eccentric will be either more or less than half the travel of the valve.

Thus for instance:

Example 30—Fig. 161. If the upper arm *A* of the rocker is 10 inches, and the lower arm *B* is 12 inches long, and the travel of the valve 5 inches, what will be the eccentricity of the eccentric?

Let the line *f g* represent the position of the center of the rocker when the valve stands midway of its travel, from the center *c*, and with a radius of 10 inches, describe the arc *d e*; on this arc lay off a point *d* 2½ inches (one-half of the travel) from the center line *f g*, not measured on the arc, but on a straight line perpendicular to *f g*; in a similar manner, lay off the point *e* 2½ inches from *f g*, then the point *d* will represent the position of the center of the rocker pin when the valve stands at one end of its travel, and the point *e* will represent the position of the center of the rocker pin when the valve stands at the other end of its travel. From the point *c* as a center, and with a radius of 12 inches, describe the arc *h i*; through the point *d* and the center *c* draw a straight line intersecting the arc *h i* in the point *i*; also through the point *e* and the center *c* draw another straight line intersecting the arc *h i* in the point *h*. The distance between the points *h* and *i* will be equal to the throw of the eccentric, and half of this distance will be the eccentricity of the eccentric. If this drawing is accurately made it will be found that the throw is 6 inches, hence, in this case, 3 inches will be the distance between the centers *x* and *y* in Fig. 142, and is ½ inch more than half the travel of the valve. But now suppose the upper arm *A* of the rocker is 12 inches, and the lower arm *B* 10 inches, and the travel of the valve 5 inches as before, then what will be the eccentricity of the eccentric?

Example 31—Fig. 162. From the center *c* [as *c*; Fig. 161], and with radius of 12 inches, describe arc *d e*; on this arc lay off as before points *d* and *e*, each point being placed 2½

inches from the center line $f g$; then the distance between these two points will be equal to the travel of the valve. From c as a center, and with a radius of 10 inches, describe the arc $h i$; through the point d and the center c draw a straight line intersecting the arc $h i$ in the point i, also through the point e and the center c draw a straight line intersecting the arc $h i$ in the point h, the distance between the points h and i will be equal to the throw of the eccentric, and half of this distance will be the eccentricity of the eccentric. If this drawing is correctly made it will be found that the distance between the points d and i, that is the throw of the eccentric, is 4.16 inches, consequently the eccentricity of the eccentric will be 2.08 inches, say 2 inches, $\frac{1}{2}$ of an inch less than the travel of the valve.

The throw of an eccentric in the last two examples can also be found by the "simple rule of three, or, as it is sometimes called, "the simple rule of proportion." Thus, take example 30; instead of finding the throw graphically as shown, we may find it thus:

10″ : 12″ : : 5″ : throw

5

10)60

6 inches=the throw.

Or, if we take example 31, we have:

12″ : 10″ : : 5″ : throw

5

12)50

4.166 inches=throw.

Table 11 gives the proportional dimensions of the important parts of the eccentric and strap. Hence, to find the thickness at C, Fig. 142, we multiply the unit in table 11 by 1, and thus obtain the dimension at C in inches. By "unit" is meant a certain number regarded as one, so that when this unit is multiplied by the numbers as indicated the important dimensions in inches of an eccentric and strap will have been obtained. This unit is found in the following manner: We may assume that the friction which the eccentric has to overcome is proportional to the total steam pressure on the back of the valve, which is equal (see 16th paper) to the area of the valve face multiplied by steam pressure per square inch, consequently for finding the unit we have the following empirical rule:

Multiply the square root of the total pressure on the back of the valve by the decimal .01, the product will be the unit required; or putting this rule in the shape of a formula we have

$$.01 \sqrt{\text{total pressure on the back of the valve.}}$$

Here the decimal .01 is arbitrary, and should only be used in locomotive practice, in which it always remains the same, no matter whether the locomotive is large or small. Again, notice that the total pressure on the back of the valve depends upon the size of the valve face and the steam pressure per square inch, and since the sizes of the valve faces vary in the different locomotives it follows that this unit in table 11 will also vary for the different classes of engines.

Example 32.—Take for example, a consolidation engine with cylinders 20 inches in diameter, the average size of the valve face for these engines is 10 inches long and 20 inches wide, hence the area of the valve face is 10″x20″=200 square inches. Assume that the steam pressure in the steam chest is 120 pounds per square inch, we have 120x200=24,000 pounds, which is the total pressure on the back of the valve. The square root of 24,000 is 154 (here the fraction has been neglected), and 154x.01=1.54, which is the unit required. If now we multiply this unit 1.54 by the numbers given in table 11, we shall obtain the following dimensions of an eccentric and strap suitable to work a slide valve with a total pressure of 24,000 pounds upon its back. Thus:

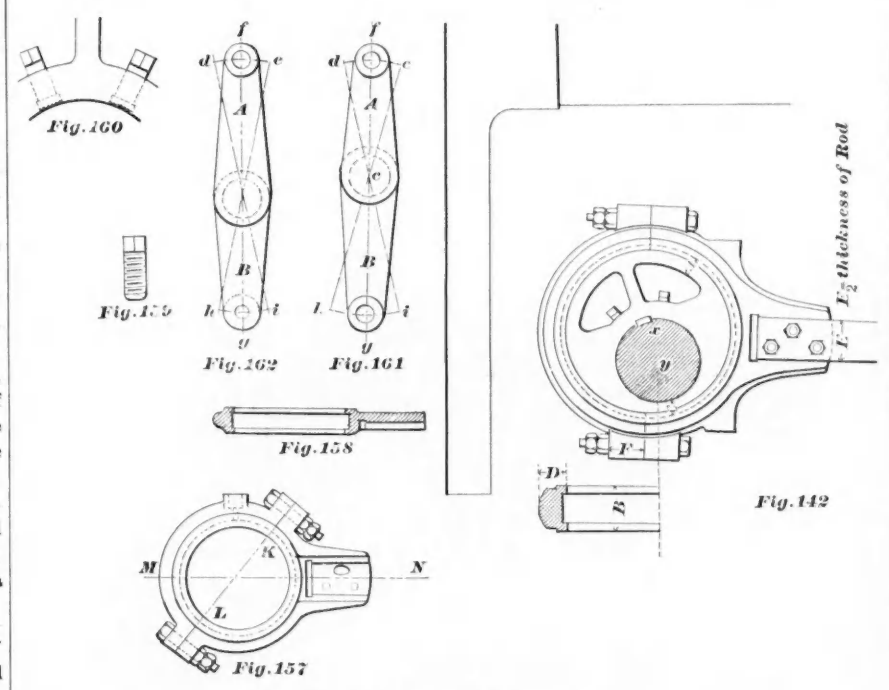
The dimen. at	A	will be	1.54×1	=1.54	in.
"	"	" B	"	1.54×2.25=3.46	"
"	"	" C	"	1.54×1 =1.54	"
"	"	" D	"	1.54×1.75=2.69	"
"	"	" E	"	1.54×2.3 =3.54	"
"	"	" E_2	"	1.54× .7 =1.07	"
"	"	" F	"	1.54×2 =3.08	"

Example 33.—Now take a small eight-wheeled passenger engine, with cylinders 10 inches in diameter. The average size of the valve face for this class of engines is 6 inches long and 11½ inches wide. Again, assume that the steam pressure per square inch in the steam chest is 120 pounds. In this case we have 6″×11.5″×120=8280 pounds pressure on the back of the valve, and .01 $\sqrt{8280}$ (that is, the square root of 8280×.01)=.91, which is the unit required. Consequently, the dimensions of an eccentric and strap suitable to work a valve with 8280 pressure upon its back will be:

The dimension at	A	=.91×1	= .91	inch.
"	"	" B	=.91×2.25=2.04	"
"	"	" C	=.91×1 = .91	"
"	"	" D	=.91×1.75=1.59	"
"	"	" E	=.91×2.3 =2.09	"
"	"	" E_2	=.91× .7 = .63	"
"	"	" F	=.91×2 =1.82	"

If we now compare the dimensions found in Example 32 with the dimensions of the eccentric and strap shown in Figs. 143 and 145, we find these to agree very closely. The greatest difference between any two dimensions is that of the breadth of the strap at B. In our illustration the breadth is ¼ of an inch greater than that obtained by the rule, but it must be remembered that the eccentric and strap shown in Figs. 143 and 145, although frequently used in modern locomotives, is very heavy in comparison with those employed in a great many other locomotives. We also find that the dimensions found in Example 33 agree closely with those shown in Figs. 152 and 154. Here the greatest difference between any two dimensions is that of the width of the recess E for the eccentric rod. The writer believes that if the width of the recess is made according to the rule given, namely, 2⅜ inches, instead of 2¼ inches, good results will follow.

Lastly, to those who are acquainted with locomotive work, it may appear that depth of the lug at F is very great when compared with the lugs on ordinary eccentric straps, but in the writer's opinion this is a great improvement, because when the holes in these lugs are reamed, the bolts turned and fitted, so that they must be driven into position, this increased depth of lug will to a great extent prevent the strap from springing out of its true circular form.



LOCOMOTIVE CONSTRUCTION.

TABLE 11.

A	= Unit × 1
B	= Unit × 2.25
C	= Unit × 1
D	= Unit × 1.75
E	= Unit × 2.3
E_2	= Unit × .7
F	= Unit × 2

Prices of Steam Fittings and Wrought Iron Pipe.

A manufacturer of steam fitters' and plumbers' brass goods, cast-iron fittings and wrought iron pipe, to the question, "How's business?" asked a few days since, replied "Good." To the question, "How are prices?" the answer was, "High." By which he explained that he did not mean too high, but just high enough, the figures being comfortably higher than they were six months or a year ago, affording a good profit, while considerably lower than they were a few years ago. The combination among the manufacturers in this line of goods is holding very well. Our informant thinks, if the wrought iron pipe pool should break down, the Pittsburgh manufacturers (who have the advantage of natural gas) would "walk away with the trade."

Cost of Patterns.

BY F. W. BARROWS.

Probably any patternmaker who is familiar with the patterns made twenty-five years ago, or even fifteen, and also with the same kind of patterns as made to-day, has noted the difference in design and also in construction of the work. This difference, where the cost of work is considered, is in favor of the patterns made now. This, of course, is the result of greater experience in the need for and use of patterns to accomplish the desired end. See, for instance, the variety of belt pulleys which may be made from a single ring and spider, with three or four sizes and lengths of hubs. It used to be the custom to make a complete pattern for each size and width of face. Now we make a single iron ring with two or three spiders of different weights, and then a lot of hubs of different lengths and diameter to match the width of face and size of shaft. These hubs and spiders are so made that any hub will fit any spider—not only the different spiders to be used with this one ring—for, of course, all pulleys made of this ring will be of one diameter—but the hubs may be used with any sized ring, as all the spiders are finished with the same-sized hole at the center, into which the hub fits. Thus you see, by having only a few complete patterns, a large variety of pulleys may be made, and made very cheaply.

Another important branch of pattern work has, in some shops, been reduced to almost nothing. This has been accomplished by the use of the gear moulding machine. The patternmaker used to make the wheel complete in all particulars, except, perhaps, in some rare instances, where different widths of face were made from one pattern. Now the patternmaker cuts from one to three teeth; the best practice uses but a single space, with a part of a tooth on each side; then the machine does the rest, and does it far more accurately than the average patternmaker could. This, you see, makes another great saving in pattern work.

Loam work has done away with a good deal of pattern work, substituting a few sweeps that are cheaply and quickly made for the costly pattern. All these tend to reduce the cost of pattern work, which is money saved in most cases.

There are some manufacturers by whom the cost of all pattern work is said to be an expense that brings no return, is all outgo and no income; in short, it is a "necessary evil." This class of men get along with just the cheapest (considering only the first cost) patterns they can make. Their castings generally have square corners and no fillets, but they are saving money on patterns to perhaps spend it in the foundry. Now, while it is good policy to make patterns cost as little as possible, don't run to extremes. You can well afford to spend more money on a pattern from which a hundred or a thousand castings are to be made than one from which you want but a single casting. If by letting the patternmaker spend two or three hours rounding corners and putting in fillets, you can save five minutes in moulding a single one, isn't it money saved by the time a hundred are made? And on a thousand a day's extra work would become a good investment. If you try to make a cheap pattern do for such a job as this, the chances are that it will become a very costly pattern before a thousand or even a hundred castings are got out.

If you want a pattern for some repairing or experimenting about the shop, and only intend, perhaps, to make one casting, you would not be willing to spend much time on it. I wouldn't either, but I should want the casting to look well, and, if it were a part of some machine, I should like it to compare in style and finish with the rest of the machine, and would be tempted to spend a little more time in shaping the pattern, and then make it up in waxing and varnishing. Perhaps you wouldn't need to varnish at all, or at most one coat of varnish ought to do for a single casting, and then the new casting wouldn't look quite so much like a makeshift job. There are a great many repair jobs done "for ourselves, you know," which are prominent examples of one kind of economy; and, where the machine work is done under the same system, the economy of the job is apt to be lessened by the frequent tinkerings made necessary to keep the thing running.

Pride sometimes has a great deal to do with the cost of pattern work. Let a new man go into a shop where they think they do things a little bit nicer than any other shop, and he will think that unless he follows their style, or what he thinks is their style (he is just as likely as not to set his standard of excellency too high), they will think that he ain't much of a patternmaker. And so he will do just the nicest job that he can, and then he will perhaps be set down as a slow hand, or one that is too fussy about his work. In many cases the foreman is to blame for this. It should be his business to so instruct a new man that he will understand just how good a pattern is wanted; but he doesn't always do this, although he generally does the best he can in his own way, and it is unfortunate for the new man that the way is not better. He is apt to put too much emphasis on the fact that we "allow ⅛″ shrinkage, and want just 3-32″ where the casting is to finish." Now, having impressed the man with the superior exactness of "our work," let him select the lumber for the man, condemning anything he may have already cut himself, and then watch him to see that he doesn't get a chance to use any of his own ideas, for, of course, the foreman's ideas are always the best, and in half a day the new man will be thinking what a fool he was to come to work in this shop, and, if he is at all nervous, he won't know whether he is afoot or on horseback, and will consequently consume more time on the job than necessary. Then, towards the end, let the foreman tell him that he is anxious to get that cast to-day, and the new man will actually be ashamed of the pattern and of having been so long about it. If you wish to find out just what a man can do, give him a job with whatever instructions are necessary. Tell him if it is a job from which but one or two castings are to be made, then let him do the rest, and my word for it the job will give better satisfaction both in time and finish.

I don't believe in making costly patterns for a job that will require only a few castings,

and it is a mistake, many times, to make expensive patterns for what is called standard work, for this reason: Suppose you are manufacturing some special line of machinery; of course you will strive to keep your machine at the head, and to do this you must adopt all improvements, and by experiments try to better anything yet made. Thus, you see, your expensive pattern would soon be ruined by the alterations found necessary; where if you had made a cheap pattern to start with you could have remade it once or twice all through, and still keep the cost within reasonable limits. This constant alteration of patterns causes them to wear out much faster than the moulder would or should use them up.

By a cheap pattern I don't mean one that looks as if it was hewed out with a broadaxe and then rubbed down by the moulder, but exercise a little common sense and make a pattern that can be molded easily and nicely; don't leave so much for the moulder to do that the casting will become expensive by reason of foundry work. A man who knows just what he wants and just how he is going to do it, two things, by the way, that are absolutely necessary to make a really cheap pattern, will cut his stuff just right the first time, and he would make every move count provided he was allowed to carry out the original ideas. This, you see, would ensure a good workmanlike job from the very start, and this would be a cheap pattern, because you see there would be no time thrown away.

In a great many cases patterns are good enough without fillets or without making up nail-holes, and for a quick job it is usually best to do away with all cauls and stavework and put your pattern up solid. There are some few cases where cauls or staves are absolutely necessary, or will save time.

When your pattern is all together see if the moulder can work it without varnishing, in short, make every move count, and don't do anything that isn't absolutely necessary.

Even on regular work there is often a good deal of time wasted, although each one can best be his own judge in regard to this, for what one would consider as absolutely necessary, another would condemn as being very foolish. It would, therefore, be impossible to say just how any one pattern should be made, and leave no chance for improvement so that it would be sure to please every man who had anything to do with it. Therefore it is likely that we shall just go on pleasing, or trying to please, the particular firm we may be working for, and when we go to another shop we can leave all of the foolish notions behind, and perhaps have to adopt some still more foolish.

Moulding Pulleys.

BY ROBERT E. MASTERS.

Moulding a pulley with a flange on each edge of the rim, when the pattern is in halves, is not so easy to accomplish as moulding a double-flange pulley from a ring pattern where one flange can be drawn out from the top of the cheek and the cheek lifted off to get at the lower flange.

In moulding a pulley of this kind from a pattern where half of the arms are attached to each half of the rim, the lower part of the pattern is laid on a smooth board as seen at *A*, Fig 1. The drag is rammed up to the depth of the pattern, and the flange *B B*, bedded in (a section of a flange will answer as well as a whole circle), a level parting is made at the top of the flange, and after the circle has been completed and the flange pattern drawn out, segment cores *C C* are laid over the rim and flange, the rest of the drag rammed up and turned over, the upper half of the pattern put on, rammed up, and the flange bedded in, the same as shown in Fig. 1 and seen at *D D*, Fig. 2.

When it is a broad-faced pulley, the sand at *E E* must be well secured, as after the pattern is drawn it is more liable to "drop" in closing than in a mould without a flange; the cores *D D*, making a parting, leave more hanging sand. In using a light wooden pattern with no holes in the arms for lifting screws, the hub *F* is screwed fast to the upper half of the pattern and a lifting screw *G*, put in to lift the pattern with the cope.

If the face of the pulley is very narrow and there is danger when ramming up the cope of the sand being rammed down into the flange at *B B*, where the flange pattern has been taken out as in the plan described above, a whole circle of segments can be used and left in the mould, a parting made at the line *H H*, Figs. 1 and 2, when the lower half of the pulley pattern is drawn out; the drag can be lifted off and the segments taken out. In this case, the bottom cores *C C*, can be dispensed with.

A three-part flask with a cheek of the right depth will be better than making the parting at *H H*, but one cannot always obtain the appliances he would like to have for these odd jobs that are usually wanted in a hurry.

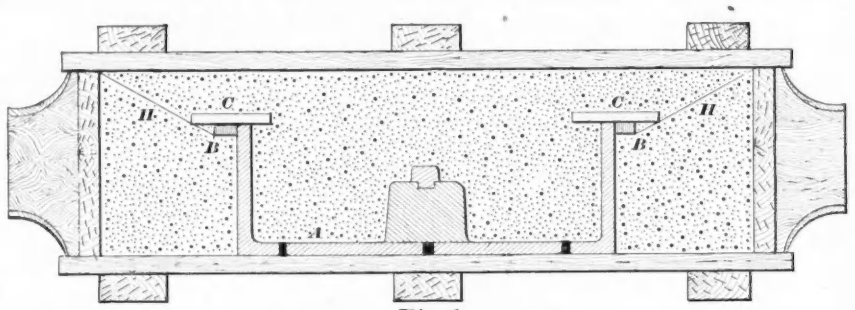


Fig.1

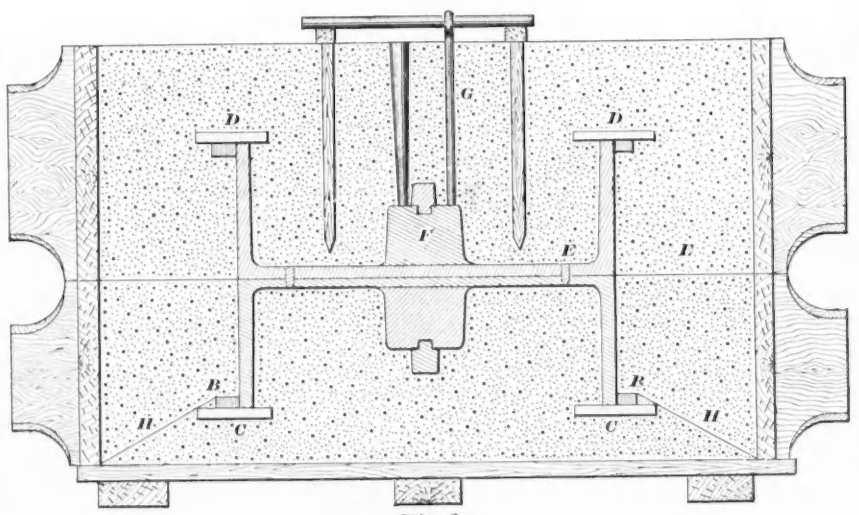


Fig.2

MOULDING PULLEYS.

A Pittsburgh gentleman, according to the *Electrical Review*, in speaking of the use of natural gas in that city, says: "Well, folks grew tired of simple logs, and now they have taken to making things of terra-cotta as well as asbestos, and putting them in grates to burn. You see, they perforate them so that little jets of flame come from all parts. One day last week I saw two life-like English bulldogs sitting in a fireplace, covered from head to foot with blue flames. Then, again, one grate I know of is fixed up with a chicken on her nest.

An 8 horse-power steam sausage mill is the latest Texas venture. The North is said to have many horse sausage shops, but we don't remember of a "steam horse" sausage mill, although "horse" may make better sausage if steamed.

LETTERS FROM PRACTICAL MEN.

A New Machinists' Union Wanted.

Editor American Machinist:

I have thought for some time that there ought to be an additional association for the benefit of journeyman machinists. And when I say benefit I don't mean to help his family after he dies or to allow him so much per week while out on a strike. But a real benefit in the shape of instruction which would enable him to obtain desirable employment, and having obtained it help him to acquire the ability to retain it.

Without attempting any exhaustive description of what such an association should do in the educational line, the following will give an idea of what my experience has found most needed. To begin at the beginning: when a boy is looking for a chance to learn the trade he should never go into an office with a large "cud" of tobacco in his cheek and a copy of the *Police News* in his most conspicuous pocket.

If he should happen to get a chance to start he must remember that his getting on will depend on how well he "snags" castings, and how far he reaches under the bench with his broom, and that his promotion will be in an inverse ratio to the speed with which he rushes for the wash room when the whistle blows.

He should be taught that there are tools in the shop which require more careful handling than the sledge hammer, and his success with the No. 4 taps (when he gets a chance to use them) will help to determine how long he will be kept at the "snagging."

I would have one department for those men who "jest look in to see if they can strike a job."

Some time ago I put an advertisement in one of the daily papers for a first-class machinist. No attempt was made at brevity, but the exact sort of a man wanted was so clearly specified, and the requirements were so exacting, that not a dozen men in the State could have fully answered the purpose.

Well, I got seventy-four answers to the call, and this leads me to say that I would have a department or class in which to teach men that it is so uncommon to find a workman who can "do a first-class job on anything from a watch to a locomotive," that such a claim, when set up by an applicant, is apt to prejudice his chances of getting a trial. And also that when a man lets himself to do sewing-machine work, and comes in with a pair of 12-inch calipers and a forge hammer wrapped up in a very dirty pair of "overhauls," the foreman is apt to start him on a more particular job than he otherwise would.

It might also be of use to know that observing foremen usually doubt a man's ability to do "clean" work in a shop when he obviously neglects to practice it on his own ears.

What doth it profit a man to possess a fine micrometer, all wrapped up in a piece of velvet, if he doesn't know how to read it?

We had one man (I wouldn't want to hurt his feelings, but think it impossible that he reads the AMERICAN MACHINIST); he was as fine as silk (to look at), and it did seem as though the tone of things around that shop was to be raised several degrees. Of course, we didn't know much about "millimeters," but he seemed willing to teach us. Well, we didn't want to take any chances of bothering him, so he was set to putting together a machine which had been put together once before, and had been run and adjusted, and was merely taken apart to be painted. Well, he only stayed until noon, and we saved enough of the machine to remember him by.

Another applicant was a man of decided literary attainments; he hesitated at first about mentioning the subject of wages, as he said he didn't think we could pay as much as his talents demanded. Whether it was the poverty-stricken look about the place, or whether he was ashamed to ask for such high wages, I don't know; but when he named the sum ($3 per day), we didn't want him, as it is hardly possible that any mechanic of the ability he claimed to possess is working for that price. It frequently happens that men apply for work at shops where more help is badly needed, and the foreman, however honest about other things, tells the applicant an untruth, and says, "No, we don't want any more help at present," instead of which it would be decidedly to the man's advantage to tell him something like the following: "Yes, we need more men; but I don't think it worth while to give you a trial." "Why?" "Well, I'll tell you; but don't get mad about it, for it's of no interest to me, and it may help you to get a job at the next shop. I noticed that when you came in the door, instead of making known your business, you sauntered around the shop, and spoke to a number of workmen, while your dirty hands were plunged deeply into your dirtier pockets, and when you got near me, I noticed a flavor to your breath that didn't come from drinking ice-water. I also noticed that your face hadn't been washed lately, and that your collar seemed to be in sympathy with the rest of your make-up; and taking you up one side and down the other, you are not just what we want."

It frequently happens that a man who looks and talks well is not a good workman; but his chances of getting a trial are much better than are those of the one described above.

Untidy appearance, too much talk, a want of politeness, and trying to talk of things not fully understood, are among the points to be avoided by workmen looking for a new place.

The country is full of machinists and other workmen who are out of employment, and among them there are many worthy men and good mechanics, but they are not in the majority, and one reason is that we have no good system of apprenticeship, and another that so many parents prefer to have their boys "employed" in a "store" rather than to have them "work in a shop," and many of those same boys, when grown up, will lament the fact that they didn't learn a trade.

If a boy has got the elements of success in him, he is fully as apt to "amount to something" by starting at some mechanical trade as though his early life were spent behind a ribbon counter, and if he is to be always a subordinate, he can surely earn better pay in a factory than in a store.

I have had ample opportunity to observe the practical machinist at his bench in several of the leading cities of this country, both East and West, and it is my opinion that there is not at this moment a single first-class man in the United States who cannot, if he really wants to work, obtain employment within a week.

What the machinist's trade wants is not more hands but better heads.

STERLING ELLIOTT.

Newton, Mass.

Dimensions of Wrought Iron Pipes in England.

Editor American Machinist:

A few weeks ago you requested some information regarding the dimensions of wrought-iron piping as used in Great Britain. Since then I have endeavored to get this information, but have had some difficulty in so doing, as there is no standard in use here, and but little published on the subject.

The Whitworth shape of thread is usually adopted, that is $\frac{1}{6}$ of thread top and bottom is rounded, but this is not accurately followed,

and if pipe and fittings are not purchased from the same makers, it is doubtful if they will fit.

Below I have tabulated the information gathered, which I trust will answer your purpose.

You will note that they have several sizes not used in the United States. I do not think they are necessary, still they are used here to a certain extent.

Nominal Diam.	Threads per Inch.	Outside Diam.	Weight per 1,000 Feet.
1-8	28	7-16	280 lbs.
1-4	19	9-16	401 "
3-8	19	11-16	606 "
1-2	14	13-16	870 "
5-8	14	15-16	..... "
3-4	14	1 1-16	1,176 "
1	11	1 5-16	1,792 "
1 1-4	11	1 5-8	2,520 "
1 1-2	11	1 7-8	2,968 "
1 3-4	11	2 1-8	3,920 "
2	11	2 3-8	4,480 "
2 1-4	11	2 5-8	5,320 "
2 1-2	11	3	6,675 "
2 3-4	11	3 1-4	.....
3	11	3 1-2	.....
3 1-4	9	3 3-4	.....
3 1-2	9	4	.....
4	9	4 1-2	.....
4 1-2	9	5	.....

The nominal diameter given in the table is the usual inner diameter for gas or ordinary steam pressure; if the pipe is made stronger the extra thickness is taken from the inner diameter, leaving the outside size always the same. The threads on the pipe are usually straight, and are made taper only when specially ordered, even then the taper is too slight to be of much use.

Joints are usually made or attempted with a jamb nut and a piece of marlin; sometimes these are tight, more often not. Cast-iron pipe is used in many places, even for small piping, and to an extent that would not be tolerated in the United States, and I can only explain this use by the difficulty they have with the leaking joints on wrought pipe.

Fittings, viz.: couplings, elbows and tees are made of wrought iron to a very large extent, and are very neat, light and strong, only spoiled by the straight thread they have adopted; each elbow has two and each tee three nuts with the packing liable to blow out at any time.

Wrought iron is called malleable iron here, and what you call by that name is known here as cast malleable; these names are entirely correct, but rather confusing to a stranger. A. G. BROWN.

Next Meeting of the American Society of Mechanical Engineers.

Secretary Hutton has sent to the members an addenda to the seventh catalogue of the American Society of Mechanical Engineers. It contains ninety four additional names, making the total membership 700. The Secretary announces that the fourteenth convention will be held in New York City during the week immediately following Thanksgiving week. The exact date will be made known later. Applications for membership should be returned to the office of the society before Oct. 15th, to insure being balloted on before the next meeting. Owing to the rule calling for the printing and distribution of papers before the meeting, the text should be in the Secretary's hand before Sept. 22d. Members are requested to send their queries for "Topical Discussion" at least four weeks before the date fixed for the meeting.

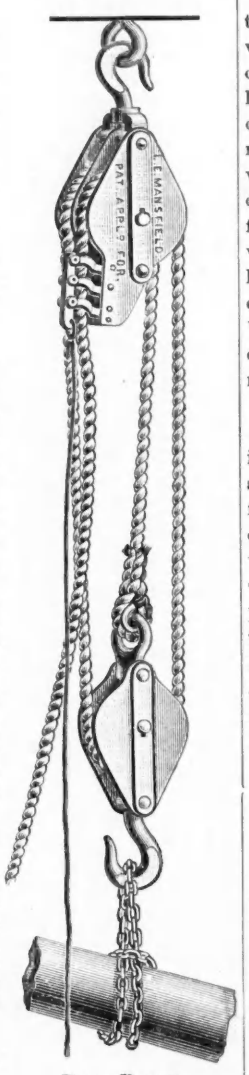
It is said that the contract for the cable of 26 miles of cable road, to be built in Melbourne, has been given to a firm in this country; also that the cars will probably be built here.

A daily press reporter, in telling about the recent fire at the Brush electric light station in New York, made the paper say: "It was feared at one time that the engine would blow up, but that danger was averted by cutting off the steam from it."

Self-Sustaining Rope Block.

The annexed engraving presents a view of the Mansfield Automatic, Self-Sustaining Rope Block attachment, a device applicable to all rope tackle blocks, whether wood or iron.

As shown in the engraving, the device consists of two or more metal rings encircling the haul rope of a tackle in such manner that the rings encircle the rope perpendicular to its axis when lifting is being done by the tackle. When the haul rope is released, the rings are turned by the rope as it moves in the opposite direction, until they lie as parallel with the rope as its thickness will permit. Movement of the rings is only limited by movement of the rope in a backward direction, and this movement of rope is limited by friction between rope and rings, therefore the action becomes automatic, and any load the rope will bear is sustained at any point. This grip does not kink the rope as is the case with tent line wooden fastenings. Kinking by one ring is prevented by the next ring, thus causing the grip to hold by friction pure and simple.



ROPE BLOCK.

When it is desired to let the tackle overhaul, a slight pull upon the small cord shown pendant from the grip device, will cause the rings to let go their hold on the rope, assume their original perpendicular position, and the rope can run freely through these rings while they are thus held.

There is so little lost motion accompanying the device that ½" movements of the haul rope will be secured by the grip. Heavy lifts may be made by one man which would be impossible without the self-sustaining attachment, as with such heavy loads, the hand over hand movement is impossible, but with the grip, the load may be raised by a succession of short jerks upon the haul rope.

In "swaying" up a hard lift, this grip works very successfully; it also can be used wherever blocks are used, and enables the rope tackle to completely take the place of chain-falls.

These blocks are made by L. E. Mansfield, 374 Union street, Brooklyn, N. Y.

Wilson's Valve Motion.

The *Chicago Times* has a long account of the performance of the locomotive fitted with the Wilson's valves and valve motion, on the Chicago and Alton Railway, which we have previously noticed. The *Times* is inclined to put the saving of the new valve motion at about 50 per cent. as compared with the link. Making due allowance for our daily contemporary's enthusiasm, and judging from what we know otherwise of the matter, we are inclined to believe that Mr. Wilson has worked out a very efficient device, and one that will be heard from in the future. We look upon the inventor as one of the clearest-headed men on locomotive valve motion in the country.

The Standard Oil Company, which started in 1869 on almost nothing, and which has accumulated a property of $100,000,000 in fifteen years, has extended its influence over every section of the country. When oil wells were drilled in Los Angeles, the Standard Oil Company opened war upon the local company, and it induced the railroad company to refuse rates to its little rival. Then the local company built a pipe line to the sea, and now snaps its fingers at the big monopoly and its railroad creature.—*Philadelphia Record.*

The Sterling Shaking Grate and Dead Bar.

This invention consists of a hood or header at front and rear ends of the furnace, set off in partitions to separate and protect ends of bars. The header is securely bolted to side frames, resting on bearing bars in the furnace. The side frames have slots to receive a cross bar, projecting from which are two lugs with two V-shaped notches, in which rest rockers.

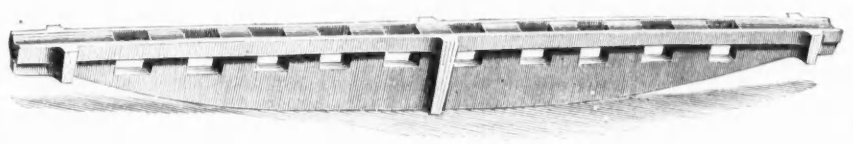
The front rockers have projections which engage in a movable link with socket for lever. The grate bar also has V notches, and rests on top edge of rockers. A lateral movement of the link gives an alternate reciprocating motion to the grate bars; also a jarring vertical motion is communicated to grate bars by the upper part of rockers describing a portion of a circle in their movement. The bars are made perfectly plain on sides, having no projections to clog and catch in one another.

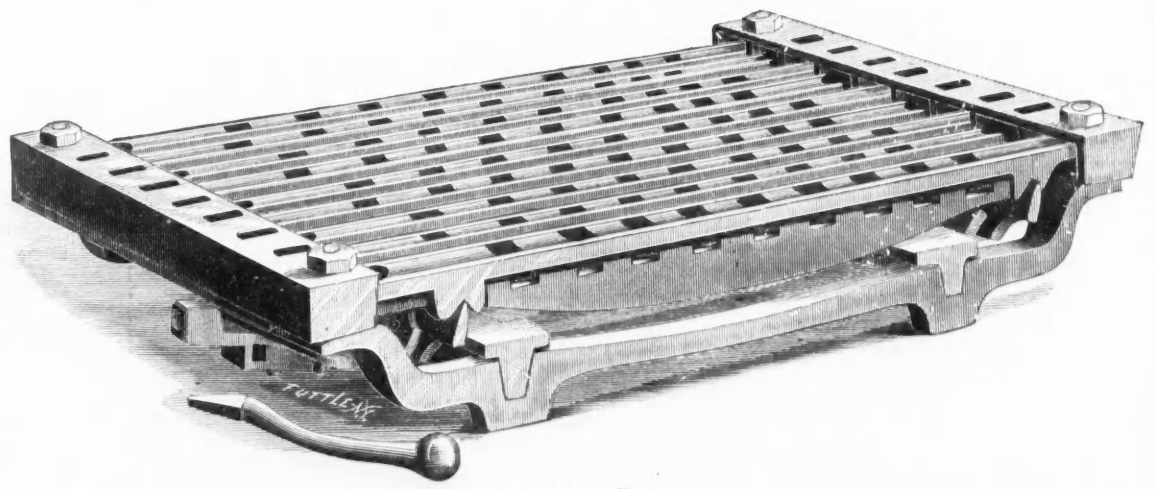
The bars are cast with rectangular holes through top and sides, thus giving a larger amount of air space. This also prevents warping and buckling of bars by having the metal equally distributed.

This invention can be applied to any ordinary furnace without change, either as shaking or stationary bar, and is easily adjusted. The rectangular holes through the bars enable them to burn fine coal without diminishing the air space.

The furnace door being closed when the grate is shaken, retains all the gases, save the boiler, and necessarily saves coals. The construction is very simple, with nothing liable to get out of order.

These grates are now being manufactured by the Sterling Grate Bar Company, 721 Broad street, Newark, N. J.





THE STERLING GRATE BAR.

A Good Field for an Invention.

There is a great field for invention, which has so far been entered but to be immediately abandoned, in this State; that is, the manufacture of a horse or steam-power cane-cutter to harvest our cane crops. The cost of simply cutting an acre of good cane in this State is about $6.25, or at the rate of 25 cents per ton, estimating an acre to yield twenty-five tons, and that it requires five first-class hands to cut it in one day. In the manufacture of Louisiana's last crop of 250,000,000 pounds of sugar, about 2,750,000 tons of cane were ground, estimating the yield at about ninety pounds of sugar per ton. Thus, for the single item of cutting cane (only a fragment of the harvesting expenses) $700,000 were paid. We have been shown the latest invention in the shape of a cane harvester, which, we learn, will soon be exhibited before the Louisiana Sugar Planters' Association. Theoretically this would work well in straight-standing cane. In cane that was blown down, tangled and crooked, as is usually most of the heavy plant cane of the State, it would apparently be useless. In seventy days the inventor of the new cane harvester will be afforded ample opportunity to work his ingenious machine. If it succeeds, he will be able to move into a millionaire's residence before Christmas. If not, he will have the satisfaction of knowing that he has gone to join a large army of geniuses who have just missed being of immense benefit to mankind. The man who succeeds in inventing a cane cutter to harvest only the straight, standing cane will accomplish a great work for this State; and the principle of the machine noted seems to be wonderfully well adapted to the purpose in view, but practical trial can be the only test of success in the case.—*New Orleans Times-Democrat.*

The editors of *Industries*, published at 70 Market street, Manchester, England, offer a reward of 100 guineas for the best electro-motor, the complete drawings and specifications to be submitted to them on or before Dec. 31, 1886. All rights and patents in the motor will belong to the inventor. The motor is to be 10 horse-power.

Once in a while, and sometimes oftener, the Harrison Boiler Works, of Philadelphia, favor us with a batch of blotting pads, on the back of which are inscribed a convenient monthly calendar and such brief scraps of information as users may find interesting and useful, not forgetting suitable mention of the merits of the Harrison boiler. The July pad contains one paragraph, which must be a good one, because the Harrison Company say they found it in the AMERICAN MACHINIST and thought it worth reproducing, of course with due credit.

The St. Louis *Railway Register* says:

"When the people on the Pacific Coast learn to use elevators instead of sacking their grain, they will reap a larger profit. The construction of elevators in Oregon and Washington must soon be followed by similar construction through California."

There is talk that the Third Avenue Street Railway, in New York City, will be converted into a cable road.

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NEW YORK, SEPTEMBER 4, 1886.

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Bicycle Engineering.

Machinery establishments that are looking round for new specialties may do well to give attention to the subject of bicycle manufacture. Within the past ten years nearly 75,000 machines of this class have been sold in this country, and the demand for bicycles and tricycles is increasing steadily. In England there are, as we are informed, about seventy establishments engaged in the manufacture of this specialty, while only about one-tenth of that number are so engaged in this country. The bicycle originated in France, but was improved and first manufactured in England. Its adoption there antedated by several years its introduction into this country, while the manufacture here has been largely dependent—except as to one or two varieties—upon the use of American rights under English patents. Naturally, therefore, the advantage growing out of priority has been with English manufacturers; but if American machinery concerns hereafter look out for their own interests in the usual American fashion, the present limited list of American manufacturers will be steadily augmented, with the natural increase in the number of machines sold, which should follow, owing to the increased variety of styles put upon the market.

Many machines are now in use by mechanics in this country, great numbers being used by mechanics in England. But whatever American machinery manufacturers and mechanics generally may think of bicycling as a means of gaining diversion, exercise and health for themselves individually, there is no reason why they should let slip the opportunity to build up a profitable business, if they can do so by meeting the views of the rapidly growing army of bicycle users.

There are American villages and towns where the passer-by may now frequently see in the streets almost as many bicycles and tricycles, as vehicles drawn by horses, and these machines are used by persons of all ages from six to sixty. Bicyclists, too, say the machine has been in use years enough to prove that no temporary craze is responsible for its popularity. What is true of localities such as we have referred to, unquestionably suggests, if the opinions of bicyclists are worth anything, that which is likely to come about eventually all over the country, namely, an immensely extended use of the "'cycle" in one form or another. Machines arranged to use other than hand and foot power, however, are vehicles merely, and can hardly be looked upon as meeting the chief demand of users, which is healthful and pleasurable outdoor exercise.

We are informed by users of the "wheel" that within the past few years several valuable bicycle patents have expired, while the important patent relating to the employment of "ball bearings" is to expire within about three years. This patent refers to the use of a number of small metallic balls running in a concave circular groove, and when well oiled forming a bearing which is almost frictionless. We are informed that ten dollars for each machine using these bearings is the royalty which the fortunate holders of the American rights have been able to exact on imported machines as well as those made in this country by others than themselves. Lately, also, as we are informed, there has been an arrangement to divide this royalty between the original holders, and a competing American concern, which is a significant fact if true.

Our information is to the further effect that a large number of English machines are imported into this country, and that it is the machines of the highest class and cost mainly, which are so imported. Until recently the best English makes have been made lighter usually than the corresponding American grades. Latterly, too, the English makers have been adopting the American plan of manufacture by duplication of parts.

Other things being equal, American users will be likely to prefer American made machines on the score of convenience alone, as to the matter of procuring repairs, when the manufacture of bicycles in this country reaches the point of meeting all the views of users. There are plenty of shops in the United States engaged in the manufacture of light machinery, which should soon be prepared to compete with British manufacturers in this kind of construction. When 43 lbs. of steel, almost the only material used, comparatively speaking, can be worked up in the form of a wheeled vehicle, which uses foot-power only and outspeeds the horse, which costs nothing for maintenance, and which can be sold at wholesale for $115 to $125, it would seem that there should be some margin for lower prices, as well as for profit, more especially when the present and prospective demand is considered. The question as to what American mechanical skill is likely to accomplish when aided by the resources of metallurgy and the experience of users, it once fairly takes bicycle construction in hand as a business, is one that we leave each reader to determine for himself.

A Great Mechanical Library Wanted.

The published details of the will under which the Tilden Trust is to be established in New York city, suggest the kind of benefaction that should be devised by some possessor of a great fortune, built up, as so many great fortunes have been built up in this country, by the aid of machinery and mechanics. We refer to the establishment of a mechanical library, which should not only be complete, but which should place the use of the books contained in it, of course for a limited time and under suitable restrictions, at the disposal of reputable mechanics in any part of the country.

We believe a system of registry, inquiry and surety could be provided, which, with the aid of printed forms and such individual co-operation as could readily be gained for such an object, would make such a distribution of duplicate copies of useful mechanical books, as safe for the institution as it would be beneficial to the students availing themselves of its privileges.

The number of men who are able to achieve for themselves a lasting and beneficent remembrance, by establishing such a library, and who are indebted to the skillful handling of mechanical forces for the means of doing so, is not, of course, great, but there are such. The fact that the number is small is only indicative of the increased honor that awaits the doubly fortunate giver of such a benefaction.

The latest move in the way of opposition to doing things cheaper is that of the longshoremen and oil merchants against shipping oil in bulk, which it is claimed will throw a number of men out of work. A tank steamer, recently fitted up for carrying oil will carry, it is said, three times as much oil as a vessel of the same size carrying it in barrels. No such movement will succeed, provided there are not other objections to carrying oil in bulk. It is in the line of the opposition to labor-saving machinery in general, which has done quite as much to the advantage of the working man as to any one else. It is particularly foolish to kick against the inevitable.

In these times it is useless to attempt to keep "trade secrets" from the general public. Middle-aged mechanics can remember the time in this country when in railroad shops there were certain operations, especially "setting the valves," that were carefully guarded. In small shops this was very usually attended to by the foreman, who invested the entire operation with all the mystery he could possibly weave around it. Now this is simply laughable. Men read and think too much.

In this country, in contradistinction to most European countries, nothing, as a rule, suits manufacturers, especially of machinery, better than to interest their customers in their processes of doing work. There are many parts of machines, the merits of which cannot be judged except by knowing something of the way they are made. With the machine complete as a machine, many parts of which the intelligent buyer desires to know a good deal, are beyond his criticism. For this reason, when the ways of manufacture are good, the manufacturer, instead of being anxious to hide them, is particularly interested in having them known.

Societies like the Master Mechanics' Association, and the American Society of Mechanical Engineers are doing good work in the way of shedding light upon secret manipulations and processes. While, as has been said, it is useless to attempt to keep such things secret for any great length of time, they may be held so long enough to cause useless expense and trouble to others.

There appears to be an impression among steam users that the periodical inspection of boilers by insurance companies will do away with the need of any particular care in their use. Where inspection is looked upon in this light it is likely to be a damage rather than a benefit. It was never intended that inspection should do away with the necessity for skilled attention to a boiler. The inspection of a good many so-called firemen is quite as much a necessity as that of the boilers they are permitted to abuse.

The utility of oil for "stilling the troubled waters" has for some years been a matter of dispute. This seems to have been very practically settled in the case of the steamship Werra, of the North German Lloyds. This steamship recently broke her shaft in mid-ocean, and was towed to New York by the Venetia. During the prevalence of a high sea, endangering the Werra, the Venetia towed a couple of oil bags astern, the result being that the water about the Werra was comparatively calm.

Railway Consolidation and Heavy Tools.

So large a proportion of the demand for machine tools comes from railroads that any sudden or gradual modification of that demand, to any material extent, becomes a matter of special interest to machinery establishments. Probably few persons who have observed the records of railroad building and management during the past few years, have failed to perceive the change that has been—and that not slowly—brought about.

While numbers of short, local railway lines are still being projected by weak companies, the percentage of such is vastly less than was the case a few years ago, before the era of railway consolidation and absorption set in. A large part of the new mileage now under way, or talked of, consists of extensions on the part of great railroad systems anxious to secure new feeders (sometimes these prove to be suckers), or to strengthen their hold on territory already held by them.

Where, too, the tendency of new railroad mileage is so increasingly toward the building-up of great systems, instead of short lines, the number of old-established, minor lines which are being absorbed by their more powerful neighbors, is likely to exhibit a similar increase, through financial and other causes.

It is plain that the same mileage, divided up among a dozen small and struggling railroad corporations is likely to require tools of quite a different class, as to quality and weight, from many of those which would be ordered for the same mileage by a single, strong corporation. While, of course, the kind of tools ordered will, in many cases, be governed by the work to be done, there is no doubt that the proportion of heavy tools required for railroad use is likely, for the future, to keep pace with the existing tendency toward railroad consolidation.

Literary Notes.

We have received the fourth annual catalogue of the Rose Polytechnic Institute, of Terre Haute, Ind. It contains a list of the faculty with a very plain prospectus of the work done. We note that a good deal of attention is paid to practical work. There is an appendix giving a fair idea of the examination for entrance, also a plan of the buildings.

We have from Prof. J. Burkitt Webb a copy of an address delivered before the American Society for the Advancement of Science,

at Ann Arbor, Mich., on "The Second Law of Thermodynamics." The professor very ably sustains Rankine in the attacks that have been made upon his exposition of this law.

The recently issued circular of the Department of Manual Training of Swarthmore College, Swarthmore, Pa., gives a fair idea of the advantages of pursuing this branch in that institution. Plans of the buildings and the course of studies are given.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(318) A. L., Dover, N. J., writes: I have a common slide valve engine. If I move the eccentric ahead to give 1-16 inch more lead will it seriously affect compression? *A.*—No.

(319) P. G. L., Fairfield, Conn., asks: 1. Will steam heat steel hotter than it will cast iron? *A.*—No. 2. I have a press plate 2 feet sqnare, with a hollow space 1" x22" cast in center for steam. If I use steel instead of cast iron, and make the casting lighter and steam space larger will I get more heat? *A.*—You will be able to do the heating somewhat quicker. 3. How much lighter can I have the steel casting than the cast iron? *A.*—If the steel casting is good it need only be about half as heavy.

(320) J. L., New York, will find the effect of admitting a little live steam, as through small holes after exhaust valve has closed, graphically illustrated in an article by Ed. F. Williams in the AMERICAN MACHINIST of March 29, 1884. It will be noticed that the effect is substantially the same as if more compression were brought about. Pre-admission through small passages, either in the valve or seat, is frequently resorted to in the case of old engines with separate cut-off valves changed from non-condensing to condensing for the purpose of getting more power. Such engines are likely to be rather light to stand the increased work, particularly as compression will be so much less after the change. If this early admission is brought about by excessive lead over the full length of port it will defeat the end by bringing too much and too sudden pressure to bear as a cushion to the advancing piston. But being gradually applied, it will frequently serve the purpose admirably.

(321) C. W. B., Waterbury, Conn., ask for information regarding brazing of large band saws, such as are used in the lumber districts of the South and West. What tools are used, and what kind of solder? Will it do any damage to the saw to draw the temper? *A.*—There are several methods of brazing band saws, among which is the use of brazing tongs and the blow-pipe. In either case the saw must be scarfed and held securely in place, as it is to be brazed, by means of a suitable clamp. A piece of solder, or soft, yellow brass, must be placed in the joint, which must be liberally dusted with powdered borax. Heat may be applied either with a pair of heavy-jawed, red-hot tongs, or by means of a blow-pipe and alcohol lamp, and a piece of charcoal held under the saw. Apply heat until the brass or solder melts, then press the saw ends together with another pair of tongs, which should not be stone cold, or the saw may be made too hard at the joint. The temper is destroyed at the joint, but the space is so short that the working of the saw is not affected. After brazing, true up the joint with a file, sharpen the saw, if necessary, and it is ready for use.

(322) A. S., Chester, Pa., asks: 1. What is the general practice for the capacity of air pump and condenser for a condensing engine? *A.*—There is no general practice. See answer to Question 183, May 3, 1884. 2. Should the overflow pipe from air pump be larger than exhaust pipe from cylinder to condenser, and what should be the size of each in relation to cylinder? *A.*—The overflow from air pump may be as large as the exhaust pipe, but there is not generally any occasion to make it more than half the capacity. The size for exhaust pipe will depend upon the speed of piston. One-third the diameter of cylinder is generally ample. 3. What should be the size of injection pipe? *A.*—This will depend upon its length; upon whether or not it is straight, and upon the lift. You will find this explained in a way to cover different conditions in engineers' pocket-books, to which we must refer you. 4. Is it a good practice to make both plunger and ring in a pump of brass? *A.*—Under certain conditions, yes. 5. When putting a cast-iron nozzle on a boiler, what is the best way to make a joint? *A.*—By riveting and caulking. 6. What should be the sizes of feed, blow-off, and steam pipes for certain size boilers? *A.*—There is and can be no rule for this, except practice and good judgment. 7. Is an evaporation of 10 lbs. of water to one of coal considered good? *A.*—Yes.

BUSINESS SPECIALS.

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Patent Att'y, H. W. T. Jenner, Washington, D. C.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Korting Exhaust Steam Condenser. Send for descriptive catalogue K. A. Aller, 109 Liberty st., N.Y.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

20", 25," 28" B.G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

20,000 addresses of steam users and users of mach. in 10 States, $10. J. N. Mills Pub. Co., 30 Vesey st., N.Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Aug. 21, p. 13. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Governors, Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Wanted—Numbers 1, 2 and 4 of volume IV., 1881; must be in excellent condition for binding, if soiled we cannot use them; for copies described as above we will pay 25c. each, and prefer to have the whole three if possible. Parties favoring us will kindly write name and address on wrapper. AM. MACHINIST Publishing Co., 96 Fulton street, N. Y.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES.

H. L. Penery is building a saw mill at Honkville, Tenn.

Robert George is building a saw mill near Francisco, N. C.

Cobbs & Mitchell, Cadillac, Mich., will remodel their saw mill.

The Knights of Labor will erect a stove foundry at Spring City, Pa.

Wm. Newcomb, Tenafly, N. J., will rebuild his mill, recently destroyed by fire.

The City Council of Thomasville, Ga., has voted $15,000 for water-works.

O. D. Wetherell, 2514 Quarry street, Chicago, Ill., will build a $20,000 planing mill.

The Hassanamisco Water Company have begun to erect their works at Grafton, Mass.

The Samuel Bunting Company, Cornwall, N. Y., will build a large carpet factory at Montana.

Wm. Pretes, Sheridan, Mich., will build a shingle and saw mill at Forest, north of Bay City.

The Ring Machine Company has been organized at Portland, Me., to build machinery.

The Shenango Machine Company, Sharon, Pa., will build extensive additions to their works.

J. Philbrook, Portland, Me., will build the Maine Central shops at Waterville, Me.

The Baxter Stove and Manufacturing Company are building large stove works at Birmingham, Ala.

The Electric Light Co., of North Attleboro, Mass., will extend its plant to Attleboro and Attleboro Falls.

A factory for preparing sun palmetto for hats and mattresses is to be built at Tampa, Fla., by G. W. S. Brown.

The Northwestern Malleable Iron Company, of Milwaukee, is increasing its capacity by the erection of new buildings.

The furniture factory of Cutler, Cremer & Co., Sturgis, Mich., is to be changed into road-cart and carriage works.

Moore & White, Thirteenth and Buttonwood Streets, Philadelphia, are building a new shop for the manufacture of paper-mill machinery.

The Paine Shoe Lasting Machine Company has been incorporated in Minneapolis, Minn., with a capital of $1,000,000.

The Franklin Needle Company expect to build a 60x100 factory, and to remove their business from Lake Village to Franklin, N. H.

Chollar & Weidprecht, who recently erected machine shops and boiler works at Fort Worth, Tex., will soon add an iron foundry.

The American Screw Company, Providence, has bought the plant, rights and privileges of the Harvey Screw and Bolt Company, of New York.

According to the *Baltimore Manufacturers' Gazette*, it is probable that machine shops will be built at Van Buren, Ark., by the Kansas & Arkansas Valley Railroad Company.

The work of rebuilding the Kniseley & Miller buildings in Chicago, recently destroyed by fire, will be commenced immediately. The new plant will cost some $30,000.

The American Wire Nail Co., New Castle, Pa., have ordered their nail machines from Germany, and expect to have them on hand ready to put in their new buildings as soon as they are completed.

Mitchells & Butterfield, of Amsterdam, N. Y., have purchased of C. D. Austin a water-power and land at Rock City, and will erect a mill for the manufacture of red shoddy.

It is stated that in addition to the two buildings lately purchased by the Edison Machine Company, in Schenectady, N. Y., two more buildings will be built. The four buildings will accommodate 1,200 machinists.

The Hoppes Manufacturing Company, recently organized at Springfield, Ohio, are building new works and putting in new machinery to manufacture the Hoppes feed-water heater and lime extractor.

Trump Bros. Machine Co., Wilmington, Del., write us: We are running more hands and have more work on hand and in prospect than ever before since our organization. Hosiery machinery forms the bulk.

The local electric lighting company, of Springfield, Mass., according to the *Republican* of that city, is arranging to add a power system to their lighting plant, available for all uses from running elevators up to printing offices and manufacturing establishments.

The Spring Lake Clinker Boat Manufacturing Company has been organized with a capital of $10,000 at Spring Lake, Mich. The company has rented all the buildings known as the R. R. plant, and will make changes and repairs necessary for boat building.

Oliver & Roberts Wire Company, of Pittsburgh, have just started a new plant for drawing cast steel, steel spring and other special wires, and also for tinning wire. They are going more extensively in the manufacture of general market wires.—*Iron.*

The Peerless Manufacturing Co., Louisville, Ky., has issued a circular explanatory of the use of sand-moulding machines made at their works. The circular is excellently well printed on a superior quality of paper, and is well worth the consideration of those engaged in making castings.

The foundations are nearly laid for the pulp mill being erected by Fletcher, Pack & Co., at Alpena, Mich. The building will occupy several lots on Fletcher street, opposite the company's saw mill. There will be four boilers for converting wood into pulp. The four towers for making sulphuric acid will be 105 feet in height.

A co-operative shoe factory is about to be established in Trenton, N. J., by the Knights of Labor. Articles of incorporation have been filed by John McGowan, John McCann, Robert Elliott, Geo. Hack, Peter O'Loughlin, Christopher Thompson and Benedict Newback. The capital stock will be $10,000, and there are to be 2,000 shares.

The Springfield (Mass.) *Republican* says there is good prospect that the Pittsfield Steam Power Company will have as a tenant a large silk manufacturing concern from New Jersey, who are now in correspondence with the company. The silk mills already in the town had their eyes on the same building. The building is 3½ stories high, 200x50 feet, with steam power at hand.

A year ago Treasurer Sperry, of the Sperry Mfg. Co., Ansonia, notified his employes that anything above a 6 per cent. dividend made by the company would be divided among them. The men were surprised Wednesday by receiving amounts varying from $20 to $75, the company having declared an 8 per cent. dividend, 2 per cent. of which was distributed as stated.—*Meriden Republican.*

A correspondent writes us: "I noticed some fun poked by you at the aluminum companies. The Detroit concern, of course, is open to more or less ridicule, but there is a man named Cowles who has got into it in the right shape. His plant will work a revolution in this industry." Our correspondent refers in the last portion of the above paragraph to the Cowles Electric Smelting and Aluminum Co., 72 Frankfort street, Cleveland, Ohio.

The Penn Hardware Co., Reading, Pa., have nearly completed very extensive additions to their works. They have carried the two-story part of their old building up another story, 108x30 in dimensions; added to the opposite end of building a three-story structure, 35x30; and facing on another street is an entirely new building, 30x170 feet, two stories high, and an office, 28x60, also two stories. This will increase their works to a capacity of 450 men, which force they hope to have at work as early as Sept. 1.

The Little Falls Knitting Mills, of Little Falls N. Y., have decided to increase their steam power by the addition of a 100 horse-power boiler, and have ordered a Moore boiler of the National Water Tube Boiler Co., New Brunswick, N. J.

An iron "bridge" is being built at R. F. Hawkins' foundry, Springfield, Mass., for the Boston & Albany shops in that city, as a support for a complicated tackle which will lift seventy-five tons. The bridge will cover two tracks, and will lift a locomotive weighing thirty tons as if it were an eggshell. The shops have used a "drop-table" heretofore when the big drivers of a locomotive were to be taken out, but the process is long and clumsy compared with the new tackle. Another improvement is the addition of a giant planer for iron, which will work a strip twenty feet long and sixty inches wide.—*Manufacturers' Gazette.*

The foundries and machine shops in New Orleans are busy repairing and constructing new machinery for sugar and cotton plantations. The Whitney Iron Works have 170 men employed. They have done an extensive business in repairing the machinery of ocean steamers lately. In sugar machinery they are now building a large supplemental mill for Mr. Allen's Rienzi plantation. An enormous five-roller mill for Hon. Ed. J. Gay's St. Louis plantation, for which also they will ship the 300 horse-power Corliss engine that was on exhibition at the late exposition. Messrs. J. Shakespeare & Co. are working about 90 hands, their usual number, and are doing general repair work, mainly for sugar planters. H. Dudley Coleman's foundry is kept busy on light iron work, such as for cotton presses, corn mills and general repairs for cotton, sugar and rice plantations.—*Age of Steel.*

Prof. R. H. Thurston, director of Sibley College, Cornell University, has issued a circular giving the cost of testing materials, lubricants, boiler and engine tests, determining the composition of fuel, labor in workshop, price of castings stock, etc. He says: In reporting the results of experimental investigations, this department writes no opinions; it simply reports facts and figures, and, in some cases, obvious deductions from such experimentally obtained results; opinions and conclusions lie outside its province, and should be obtained from an expert in the engineering profession familiar with the subject of the investigation. Copies of the record are preserved in the record-books of the college, and, where materials are tested, one-half of the test-piece is usually retained in the cabinets of the laboratory. Where apparatus is constructed especially for the prosecution of commercial work, it is charged for as above, and remains the property of the parties ordering the investigation; but, should it seem likely that it may have useful application, later, in the work of the college, it will be, if desired, taken for such use at one-half the amount so charged, the college thus sharing the charge with those for whose benefit it was constructed.

The Consolidated Electric Light Co., of Maine, is negotiating for the establishment of a plant in Biddeford and Saco. The service machinery will be located in Holmes & Roberts' mill on Water street, Saco. The building is now being put in readiness. The Mather Electric Company, which has grown from a force of two employes to 200, and largely increased its capital, has outgrown its quarters in the old factory on Sheldon street in Hartford, and is considering the advisability of a removal, advantageous offers being made from different towns and cities, including Manchester. The Mellville Schuyler Electric Light Co., of Mellville, N. J., has been incorporated for the purpose of furnishing that city with both arc and incandescent lights, and has secured an exclusive franchise for five years. The capital stock is $30,000, and the names of its officers are Stephen Holbrooke, president, and F. J. Melvin, secretary and treasurer. A suitable lot has been purchased for the station in a central part of the city, and the contract for the electric plant (combined arc and incandescent) has been given to the Schuyler Electric Light Company, of Hartford, Conn. The steam plant will be supplied by the Ball Engine Company, of Erie, Pa., and will embrace a 100 horse-power steel boiler, and 80 horse-power Ball automatic engine.—*Electrical Review.*

Messrs. De Loach & Bros. have leased the old plant of the Georgia Machinery Co., which failed a few months ago and was sold out at receiver's sale. They will do manufacturing of all kinds in wood and iron, and will continue to manufacture their celebrated water-wheels. It is a pleasure to note the reopening of this factory. As its failure marked time of depression in Atlanta industries, it is hoped that its re-establishment is the beginning of a new era as regards the manufacturing interests of the city. Atlanta's commerce is far in excess of her factories. There are several large plants now lying idle, the companies which formerly operated them having been "pressed to the wall" by the universal depression in business for the past 18 months. Until these factories are again put in full operation, and the operatives who have left the city and whose homes are now placarded "for rent" are brought back and given work, Atlanta's trade cannot be otherwise than depressed. With Birmingham on one side and Chattanooga on the other threatening to supersede her as manufacturing centers, she has every inducement to look well into the matter of putting her factories again on their feet. It is her salvation, and her only salvation, and if she delays too long the time will be passed. With these facts staring every intelligent citizen fairly in the face, the action of Messrs. De Loach & Bros., in reopening the old Georgia Machinery Company plant is hailed as a beginning in the right direction.—*The Tradesman.*

Machinists' Supplies and Iron.

NEW YORK, Aug. 19, 1886.

Iron—In American pig the market is still quiet, with the same hand-to-hand transactions which have occurred for months past, and will probably continue for several weeks yet. We quote Standard Lehigh and North River brands $18 to $18.50; No. 2 X Foundry, $17 to $17.50, and Grey Forge, $16 to $16.50, with outside brands obtainable at about 50c. to $1 per ton less.

Scotch Pig—The demand continues moderate. We quote Coltness, $20; Glengarnock, $19; Gartsherrie, $19.50; Summerlee, $19.50; Eglinton $17.50 to $18; Langloan, $19.50; Dalmellington, $18.50.

Lead—4.75c.

Antimony—Hallett's, 7¾c.; Cookson's, 9c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Situation wanted by a machine pattern-maker. Address S. Y., AM. MACHINIST.

Situation wanted by reliable mechanical draftsman. Address N. X., AM. MACHINIST.

Wanted—By a thoroughly competent man, situation as foreman in pattern shop; large experience as foreman. G. S., AM. MACHINIST.

A mech. engineer and draftsman, with good experience on large and small tools, desires an engagement in New York. G. F., AM. MACHINIST.

Wanted—Supt. of machine works wishes to reengage; steam and heavy work; references. J.J., Care AM. MACHINIST.

Mechanical engineer, thoroughly posted in Southern machinery trade, desires position as agent or salesman for responsible house. Address L., AM. MACHINIST.

Wanted—Foreman in a small hardware factory; one who thoroughly understands the manufacturing of small tools. Address, stating age, experience and wages expected, Hardware, AM. MACHINIST.

Traveling salesmen handling engineers' and mill supplies, can make desirable arrangements to sell "Eureka" packing. Special pocket-book of samples furnished. Hine & Robertson, 12 Cortlandt st., N. Y.

Mechanical engineer and draftsman, with eleven years' practical experience in designing and construction, is open for engagement; correspondence solicited; references given. Address Mechanical Engineer, AM. MACHINIST.

Draftsman of experience and ability wants situation in or near New York City; none but permanent position is desired. Address Worcester, care AM. MACHINIST.

Draftsman and inventor, of responsible capability, wants position where inventions need perfecting; experienced on steam engines; successful inventor. A. F. Fogelquist, 367 Broad st., Newark, N.J.

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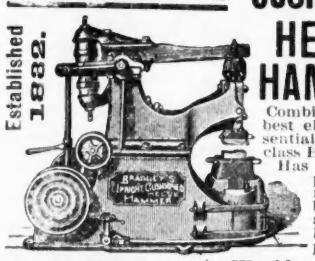

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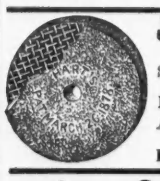

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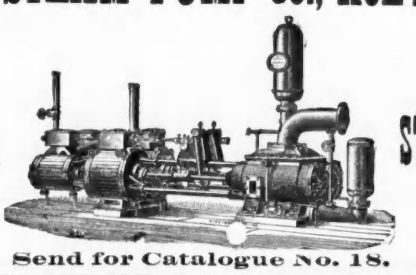

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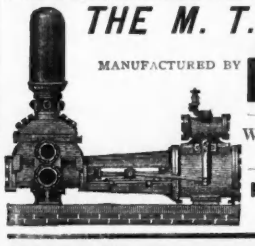

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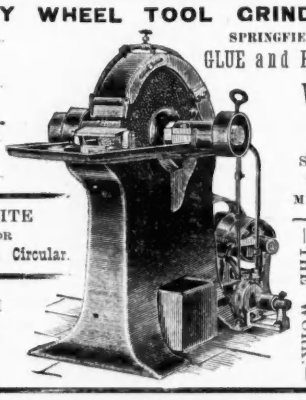

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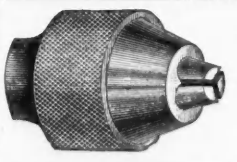

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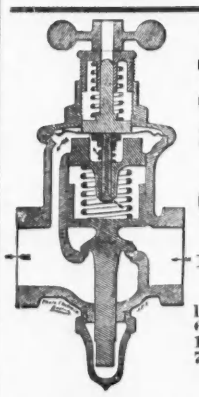

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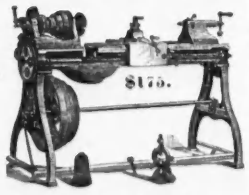

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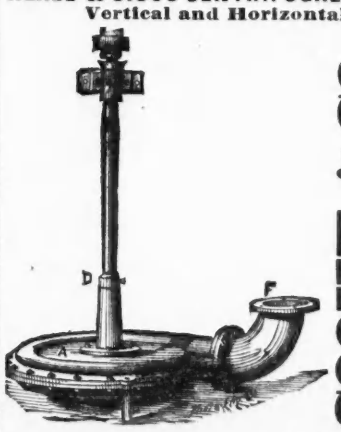

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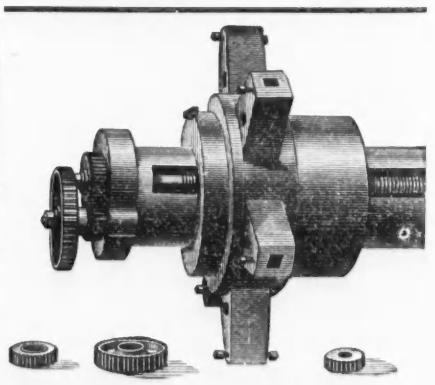

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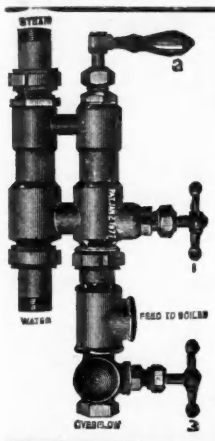

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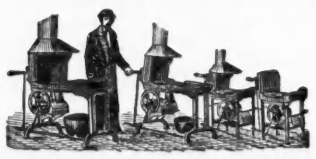

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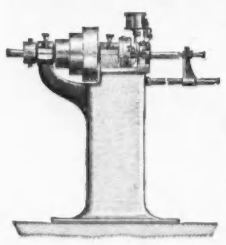

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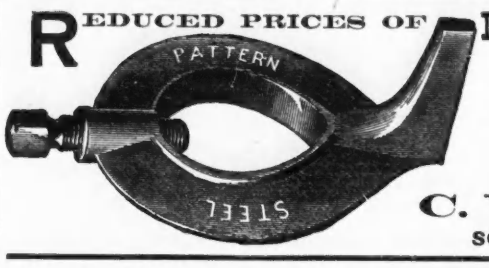

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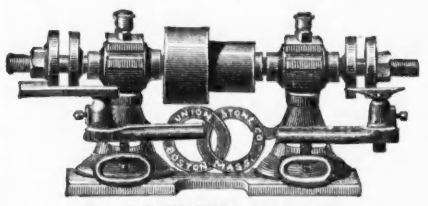

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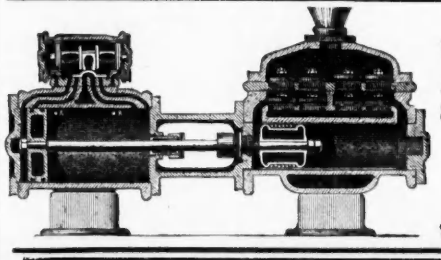

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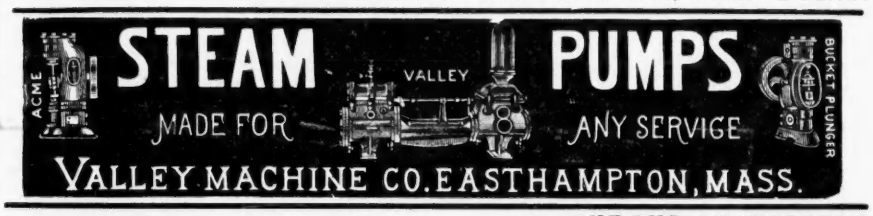

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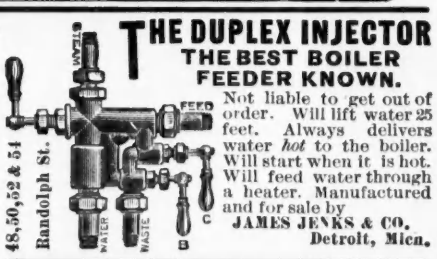

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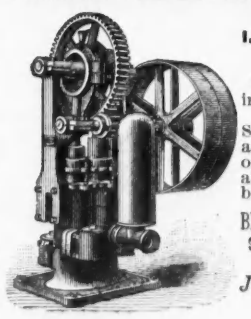

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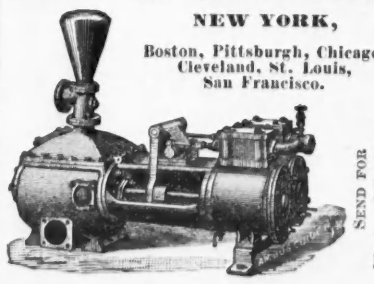

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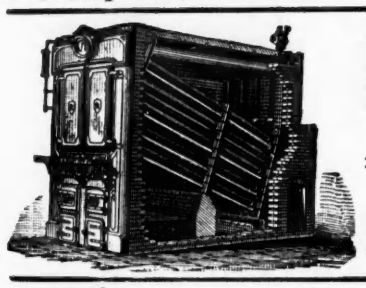

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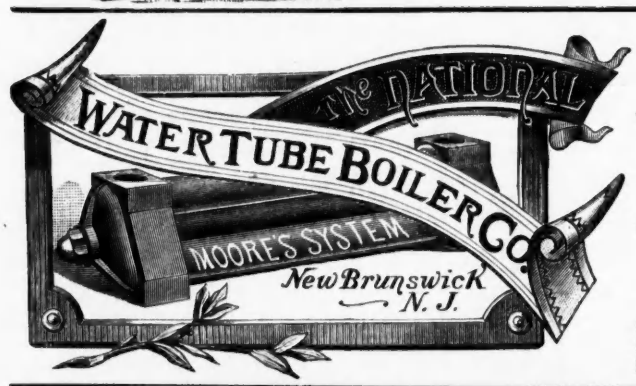

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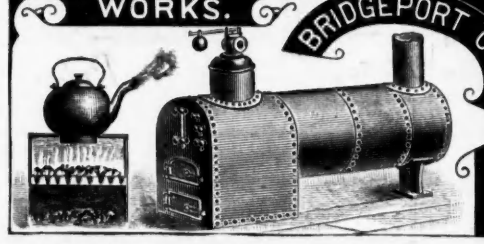

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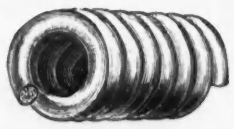

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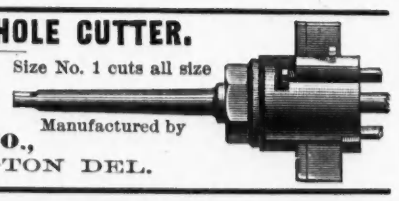
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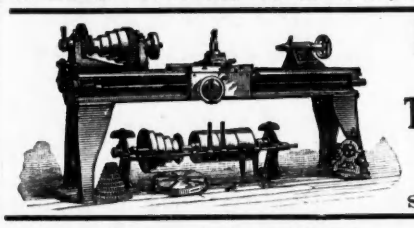

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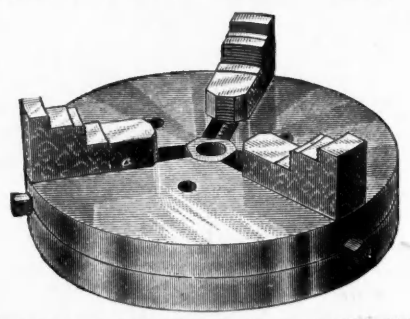
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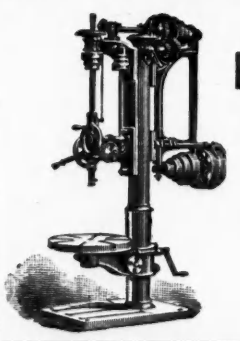
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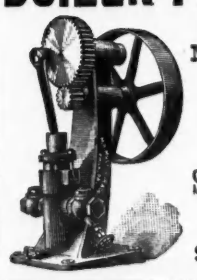
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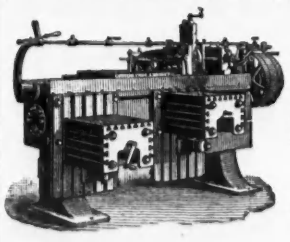
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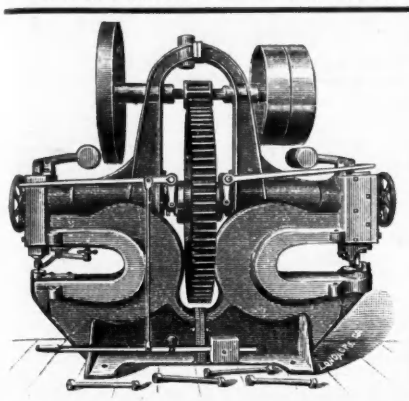

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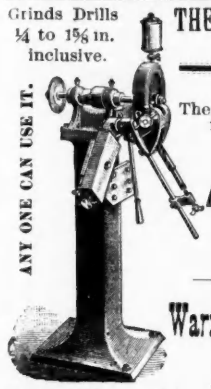

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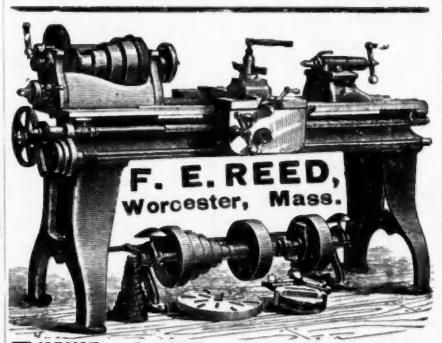

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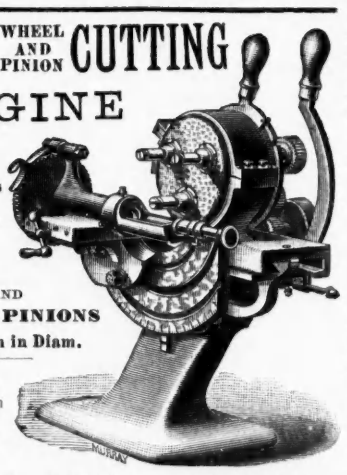

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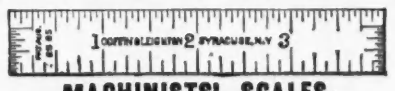

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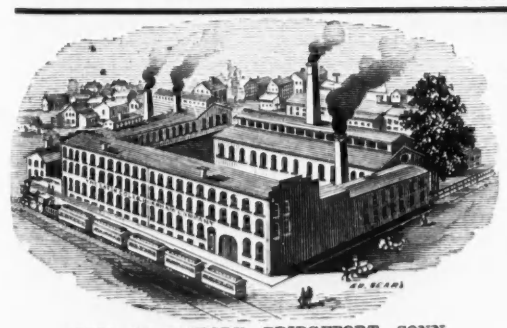

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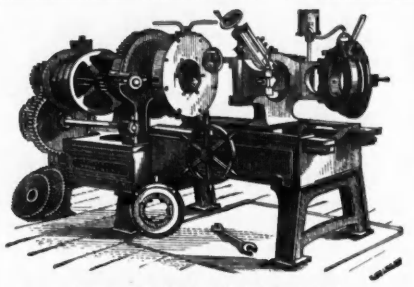

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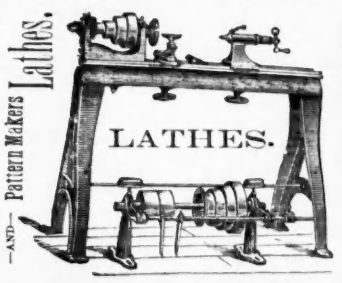

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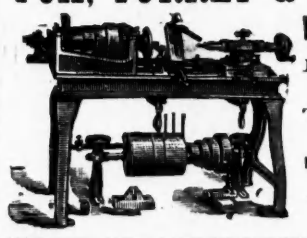

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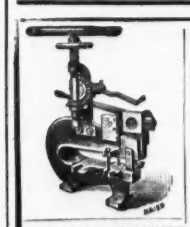

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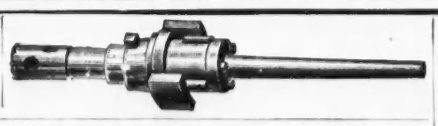

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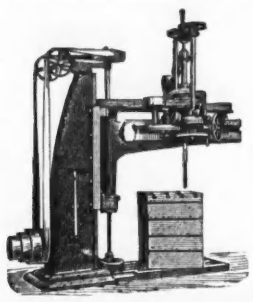

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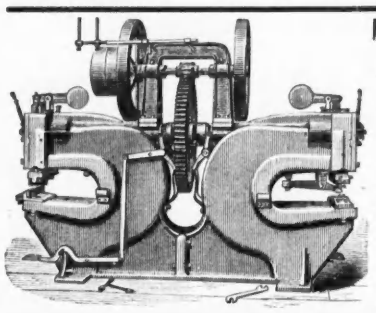

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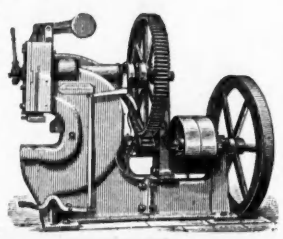

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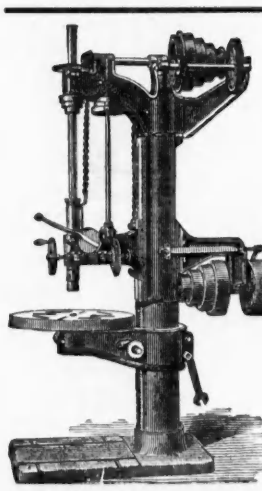

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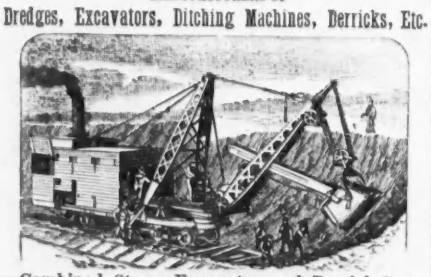

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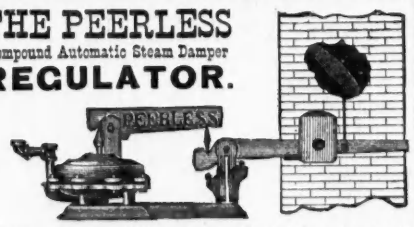

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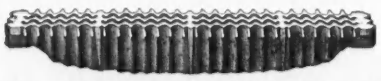

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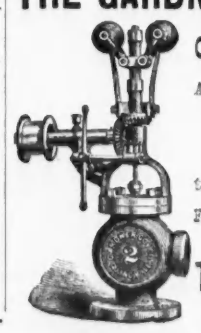

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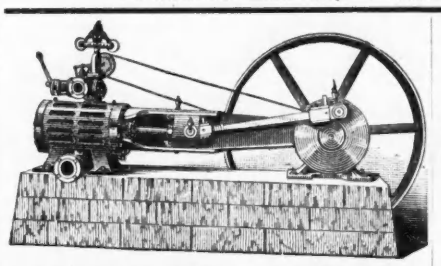

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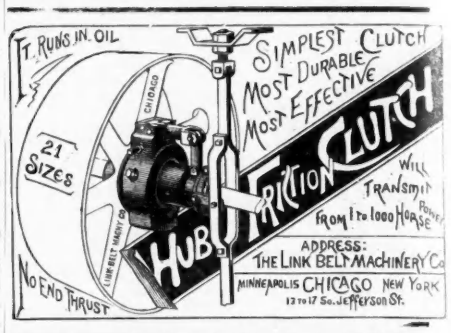

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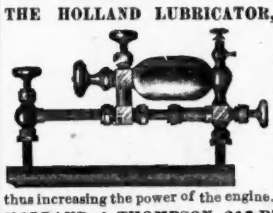

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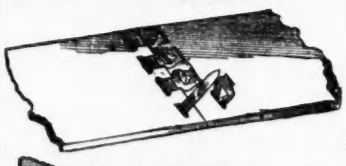

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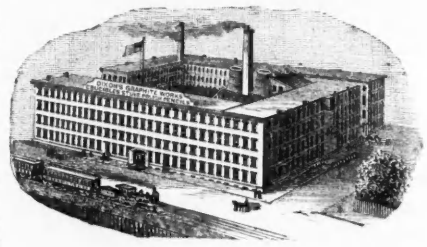

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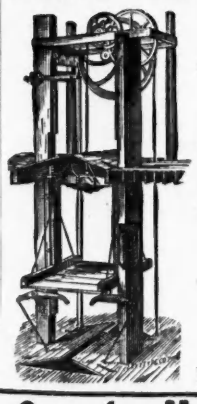

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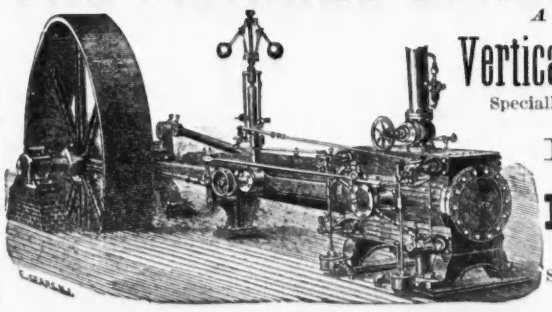

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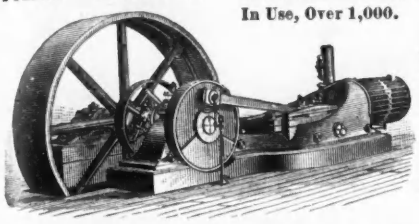

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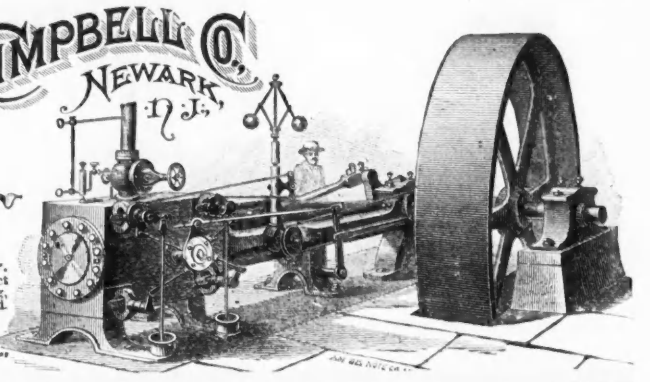

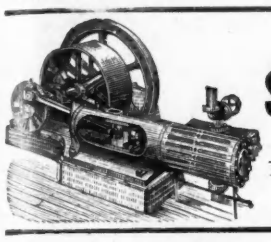

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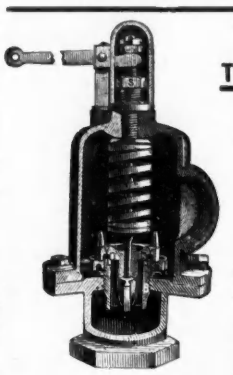

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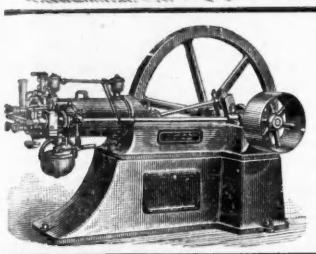

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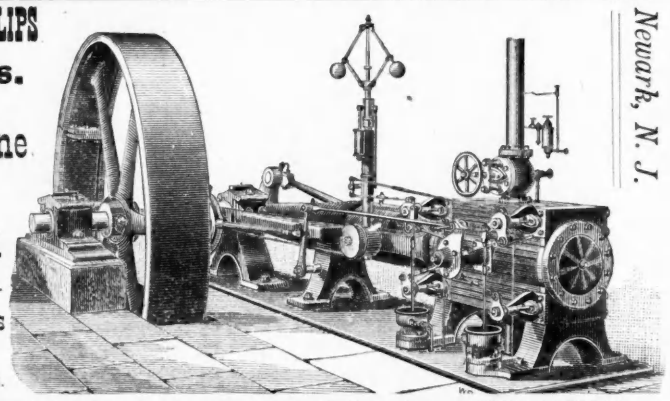

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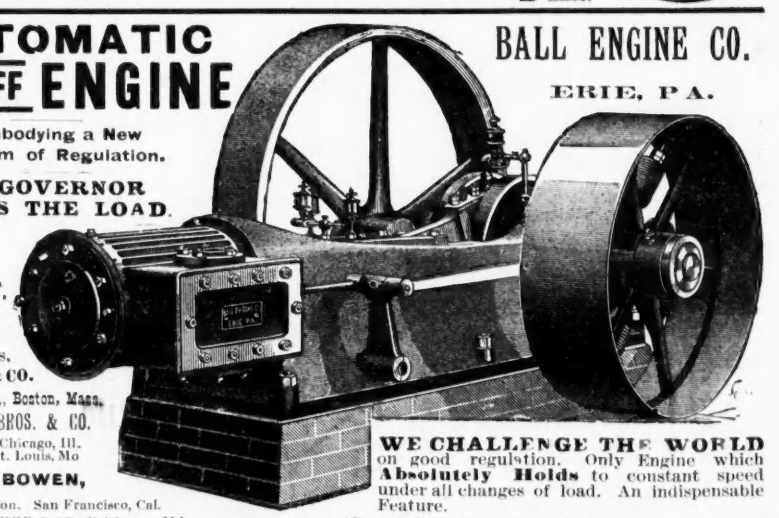

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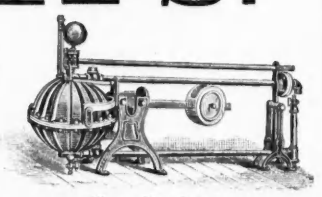

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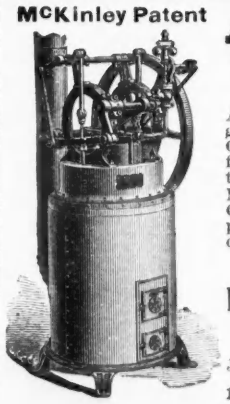

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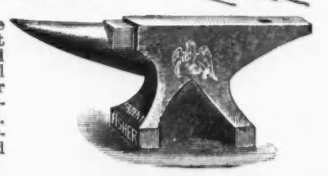

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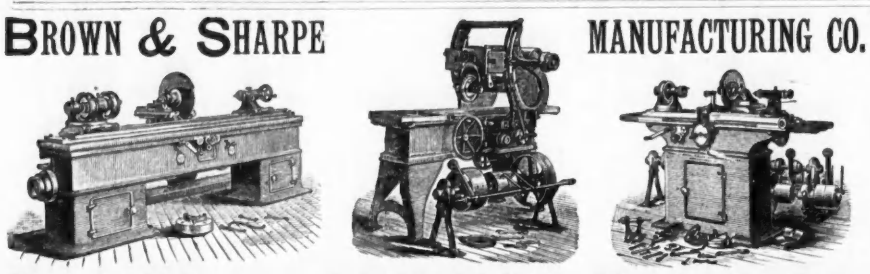

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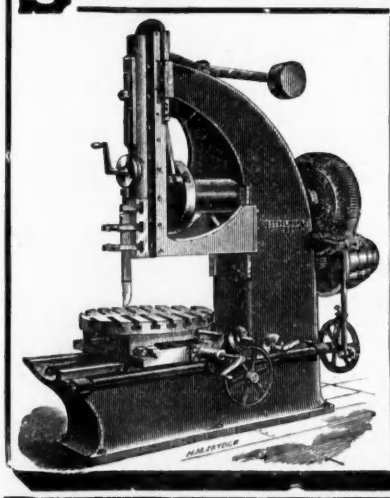

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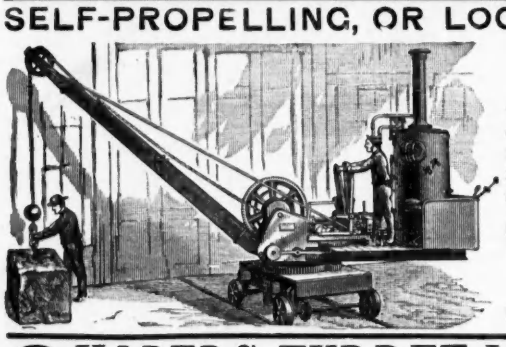

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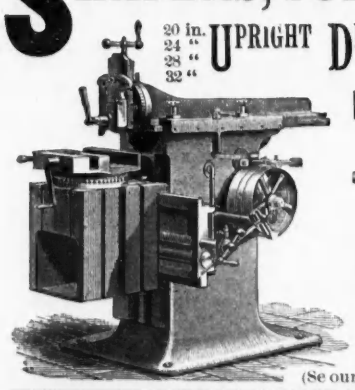

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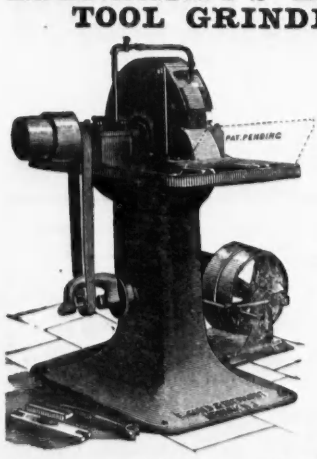

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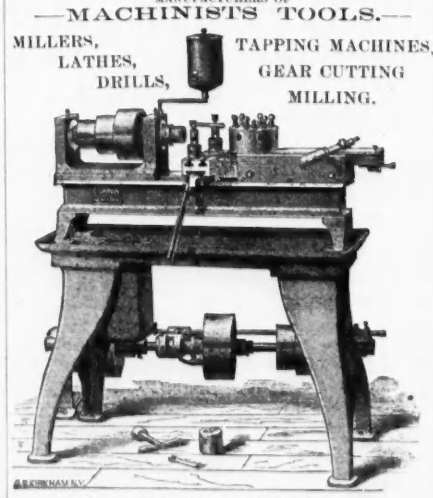

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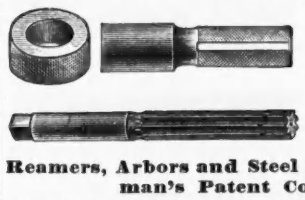

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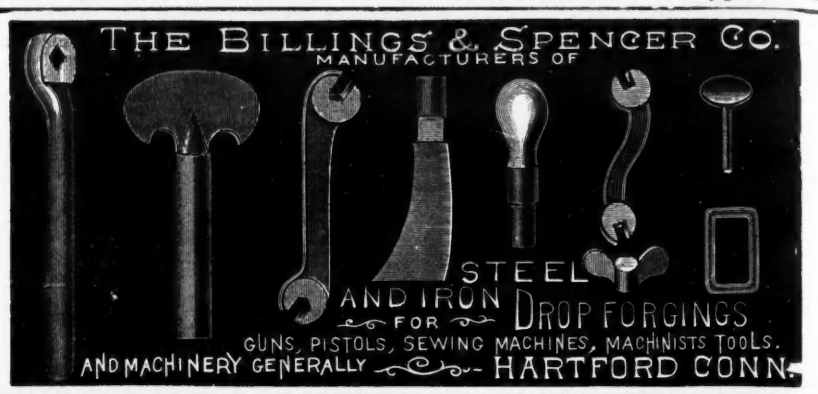

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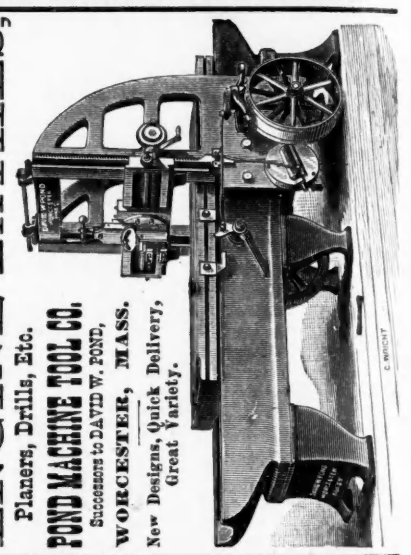

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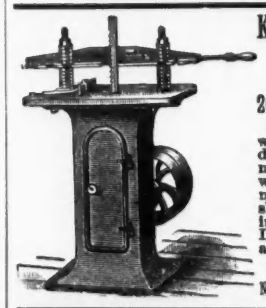

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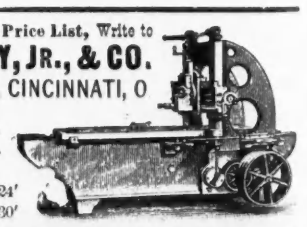

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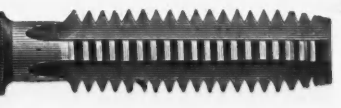

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